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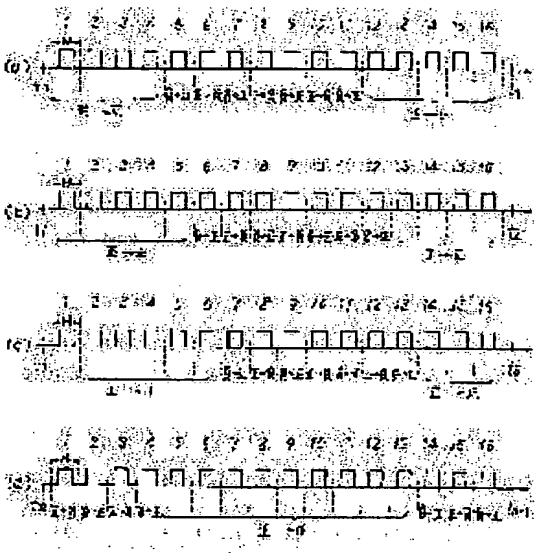
(54) LIQUID CRYSTAL DISPLAY DEVICE AND ITS DRIVING METHOD

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a liquid crystal display device with which a flicker in screen and degradation of a liquid crystal can be prevented and a luminance difference on a display screen by an inverted scanning line can be reduced.
SOLUTION: The liquid crystal display device is equipped with a picture driving control part which controls the drive of an image displayed on the picture of a liquid crystal panel. The picture driving control part uses an image area composed of a plurality of continuous scanning lines as the tone reversal area of a pixel electrode, inverts the polarity of the pixel electrode in a prescribed scanning line in the tone reversal area of the pixel electrode into a reverse polarity with respect to the polarity scanned at the last time for every frame scanning, and moves one scanning line of tone reversal area of the pixel electrode at a time.



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[Claim(s)]

[Claim 1] While two or more scanning lines and signal lines choose a sequential-scanning line from the mutual scanning line of the liquid crystal panel with which it crossed, and it was prepared and the pixel electrode was formed in each intersection in the shape of a matrix, and the above-mentioned plurality The polar signal of either straight polarity or negative polarity is given to two or more above-mentioned signal lines. It has the screen actuation control section which carries out actuation control of the image displayed on the screen of the above-mentioned liquid crystal panel. The above-mentioned screen actuation control section While making into the polarity-reversals field of a pixel electrode the image field which consists of two or more continuous scanning lines and making the polarity of reverse reverse the polarity of the pixel electrode of the predetermined scanning line in the polarity-reversals field of the above-mentioned pixel electrode with the polarity at the time of a scan last time for every frame scanning The liquid crystal display characterized by moving the 1 scanning line of polarity-reversals fields of the above-mentioned pixel electrode at a time.

[Claim 2] The predetermined scanning line is a liquid crystal display according to claim 1 characterized by being all the scanning lines in the polarity-reversals field of a pixel electrode.

[Claim 3] The polarity-reversals field of a pixel electrode is a liquid crystal display according to claim 1 characterized by the adjoining thing for which the polarity is changed for every scanning line.

[Claim 4] A screen actuation control section is a liquid crystal display according to claim 1 characterized by controlling to become a polarity which is mutually different further in the polarity of the pixel electrode of the scanning line of the up field of a screen, and a lower field when the polarity-reversals field of a pixel electrode is in the staging area of a screen.

[Claim 5] While two or more scanning lines and signal lines choose a sequential-scanning line from the mutual scanning line of the liquid crystal panel with which it crossed, and it was prepared and the pixel electrode was formed in each intersection in the shape of a matrix, and the above-mentioned plurality The polar signal of either straight polarity or negative polarity is given to two or more above-mentioned signal lines. It has the screen actuation control section which carries out actuation control of the image displayed on the screen of the above-mentioned liquid crystal panel. The above-mentioned screen actuation control section Make into the polarity-reversals field of a pixel electrode the image field which consists of two or more continuous scanning lines, and it sets to the polarity-reversals field of the above-mentioned pixel electrode. While reversing the polarity of the pixel electrode of the predetermined scanning line the scan period more than a frame-scanning period and making the polarity of reverse reverse the polarity of the pixel electrode of the scanning line which remains with the polarity at the time of a front scan for every frame scanning The liquid crystal display characterized by moving the 1 scanning line of polarity-reversals fields of the above-mentioned pixel electrode at a time for every frame scanning.

[Claim 6] The predetermined scanning line is a liquid crystal display according to claim 5 characterized by being two or more scanning lines chosen every other in the polarity-reversals field of a pixel electrode.

[Claim 7] The predetermined scanning line is a liquid crystal display according to claim 5 characterized by being the one scanning line of eye predetermined watch.

[Claim 8] While two or more scanning lines and signal lines choose a sequential-scanning line from the mutual scanning line of the liquid crystal panel with which it crossed, and it was prepared and the pixel electrode was formed in each intersection in the shape of a matrix, and the above-mentioned plurality The polar signal of either straight polarity or negative polarity is given to two or more above-mentioned signal lines. It has the screen actuation control section which carries out actuation control of the image displayed on the screen of the above-mentioned liquid crystal panel. The above-mentioned screen actuation control section When the image field which consists of two or more continuous scanning lines is made into the polarity-reversals field of a pixel electrode and the polarity-reversals field of the above-mentioned pixel electrode is in the staging area of a screen, While controlling the polarity of the pixel electrode of the scanning line of the up field of a screen, and a lower field to become a mutually different polarity The scanning line which reverses a polarity for the polarity-reversals field of the above-mentioned pixel electrode for every scan, The polar ratio of

the pixel which constitutes from the scanning line which reverses a polarity spacing more than a scan period, and is occupied in the polarity-reversals field of the above-mentioned pixel electrode The liquid crystal display characterized by making it correspond to the polarity of an up field and a lower field between the above-mentioned up field and a lower field, and making it increase or decrease, and moving the 1 scanning line of polarity-reversals fields of the above-mentioned pixel electrode at a time for every frame scanning.

[Claim 9] The actuation approach of the liquid crystal display which makes the image field which consists of two or more continuous scanning lines the polarity-reversals field of a pixel electrode, and is characterized by moving the 1 scanning line of polarity-reversals fields of the above-mentioned pixel electrode at a time while making the polarity of reverse reverse the polarity of the pixel electrode of the predetermined scanning line in the polarity-reversals field of the above-mentioned pixel electrode with the polarity at the time of a scan last time for every frame scanning.

[Claim 10] Make into the polarity-reversals field of a pixel electrode the image field which consists of two or more continuous scanning lines, and it sets to the polarity-reversals field of the above-mentioned pixel electrode. While reversing the polarity of the pixel electrode of the predetermined scanning line the scan period more than a frame-scanning period and making the polarity of reverse reverse the polarity of the pixel electrode of the scanning line which remains with the polarity at the time of a scan last time for every frame scanning The actuation approach of the liquid crystal display characterized by moving the 1 scanning line of polarity-reversals fields of the above-mentioned pixel electrode at a time for every frame scanning.

[Claim 11] When the image field which consists of two or more continuous scanning lines is made into the polarity-reversals field of a pixel electrode and the polarity-reversals field of the above-mentioned pixel electrode is in the staging area of a screen, While controlling the polarity of the pixel electrode of the scanning line of the up field of a screen, and a lower field to become a mutually different polarity The scanning line which reverses a polarity for the polarity-reversals field of the above-mentioned pixel electrode for every scan, The polar ratio of the pixel which constitutes from the scanning line which reverses a polarity spacing more than a scan period, and is occupied in the polarity-reversals field of the above-mentioned pixel electrode The actuation approach of the liquid crystal display characterized by making it correspond to the polarity of an up field and a lower field between the above-mentioned up field and a lower field, and making it increase or decrease, and moving the 1 scanning line of polarity-reversals fields of the above-mentioned pixel electrode at a time for every frame scanning.

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the liquid crystal display which can reduce the brightness difference in the screen generated in more detail bordering on the scanning line which performs the polarity reversals of a pixel electrode, and its actuation approach with respect to the liquid crystal display which used the liquid crystal display panel of an active-matrix mold, and its actuation approach.

[0002]

[Description of the Prior Art] there is no adjoining cross talk between pixels, a high contrast display is obtained, and a transparency mold display is possible for the liquid crystal display component (TFT-liquid-crystal panel) of the active-matrix mold equipped with the thin film transistor (TFT is called hereafter) as a driver element for every pixel, and it is easy to enlarge -- etc. -- since it has the advantage, it is used mostly in recent years. Drawing 11 is drawing for explaining the actuation approach of the conventional TFT-liquid-crystal panel. As everyone knows, a signal line and the scanning line are arranged in the shape of a matrix, and, as for the TFT-liquid-crystal panel, TFT and a transparent pixel electrode are connected at the intersection of a signal line and the scanning line. And a counterelectrode is prepared in TFT, the array substrate with which the pixel electrode is prepared, and the opposite substrate which counters, and liquid crystal is inserted between the pixel electrode and the counterelectrode.

[0003] The k parallel scanning lines (L1-LK) arranged along the horizontal direction of a liquid crystal panel are shown in drawing 11 . Drawing 12 is drawing for explaining the polarity of the signal given to a pixel electrode through a signal line and TFT while explaining the actuation sequence of the scanning line. Drawing 12 (a) is drawing corresponding to the image of the 1st frame formed at time of day t0-t1, and drawing 12 (b) is drawing corresponding to the image of the 2nd frame formed at the time of day t1-t2 which is a frame next to the 1st frame.

[0004] In time of day t0-t1 (namely, image of the 1st frame), the 1st - the k-th one scanning line are chosen from the upper part of a screen at a time one by one towards the lower part, the signal of negative polarity is given to a signal line

corresponding to selection of each scanning line, and drawing 12 (a) shows that the signal which the pixel electrode which was straight polarity till then holds is rewritten one by one by the signal of negative polarity. In addition, having displayed it as "a forward -> negative" in drawing shows that the polarity of a pixel electrode is rewritten by negative polarity from straight polarity. Moreover, having displayed it as "H" in drawing shows 1 horizontal-scanning period, and the change of selection of each scanning line is performed with the period of 1 horizontal-scanning period H.

[0005] Drawing 12 (b) shows that sequential selection of the 1st - every k-th one scanning line is again made towards the lower part from the upper part of a screen in time of day t1-t2 (namely, image of the 2nd frame). At this time, the signal of straight polarity is given to a signal line and, as for the signal which it responds, the signal of straight polarity is written in a pixel electrode, and the pixel electrode holds, that polarity is reversed one by one from negative polarity to straight polarity. Thus, it is for preventing property degradation of liquid crystal to reverse the polarity of the signal given to a pixel electrode for every image of one frame. If the liquid crystal inserted between the pixel electrode and the counterelectrode continues impressing direct current voltage to inter-electrode, a property will deteriorate. Therefore, the signal impressed to liquid crystal needs to change a polarity at suitable spacing.

[0006] The optical property of the liquid crystal panel using the Twisted Nematic liquid crystal generally used is not dependent on the polarity of an electrical potential difference depending on the absolute value of the electrical potential difference applied to inter-electrode. In case these liquid crystal panels rewrite the signal which each pixel section holds, as they are shown in drawing 12 (a) and drawing 12 (b), the method which also reverses the polarity of a signal is adopted. By the way, the specification the signal made to input into a liquid crystal display has image data updated on the frequency of 60Hz has spread. This specification is a method according to CRT (cathode-ray tube) which preceded and spread rather than the liquid crystal display. In the case of CRT, in order to make an electron beam guess and emit light to the fluorescent substance applied to the screen, it is because attenuation of brightness needs to update by early and the frequency which is about 60Hz.

[0007] Also with the liquid crystal display, the signal which updates data to a pixel on such a frequency of 60Hz is inputted, and the polarity is changed for every renewal of data. Therefore, the frequency of polarity reversals is set to 30Hz of the one half of renewal of data. In a liquid crystal panel, a total pixel location and a whole floor tone are covered, it is difficult to set up equally the absolute value of the electrical potential difference at the time of straight polarity and negative polarity, consequently the deflection of brightness arises. In addition, the reason with it difficult [to set up equally the absolute value of the electrical potential difference at the time of straight polarity and negative polarity in a total pixel location] is because the wiring resistance to a pixel changes with pixel locations even if the distance from X driver or Y driver to each pixel is not the same, therefore a driver output is the same, and the amount of voltage drops changes with pixel locations. Moreover, since pixel locations differ, it is because the pixel charging time also changes with differences of a time delay.

[0008] Moreover, the reason with it difficult [to set up equally the absolute value of the electrical potential difference at the time of straight polarity and negative polarity over a whole floor tone] is as follows. Namely, an electrical potential difference required for the gradation display of a liquid crystal panel is about 5V, and impresses the electrical potential difference of abbreviation**5V in the direction of positive/negative using the inverting circuit constituted from an operational amplifier etc. for degradation prevention, respectively. The gain of an operational amplifier is decided by external resistance, and since it is considered by the electrical-potential-difference value of **5V impressed in a general-purpose article since it is about 1% in 5 - 10%, and a high-degree-of-accuracy article for the rate of the change of potential impressed to be proportional to the rate of change of brightness mostly, it becomes impossible for variation to arise in the variation in the resistance of commercial resistance, and to set equally the absolute value of the electrical potential difference at the time of straight polarity and negative polarity to it over a whole floor tone.

[0009] by the way -- as long as 1% of brightness difference is range recognized easily for human being's eyes and commercial resistance is used -- a whole floor tone -- crossing -- impression -- it is difficult to arrange the electrical-potential-difference value of its ******, and to abolish a brightness difference. However, if the frequency of polarity reversals is set to 20-30Hz or more, since human being's eyes cannot be followed at a brightness response but the average at the time of straight polarity and negative polarity will be checked by looking as brightness, a flicker generated with brightness deflection is said to go into tolerance. Therefore, the present liquid crystal display inputs the signal of the frequency according to the signal for CRT, is

changing the polarity for every renewal of data, and has the advantage which can reduce a flicker easily. By the way, a liquid crystal display is used as a display of the pocket device of cell actuation in recent years. The need for reduction of power consumption for these applications is high. In the case of a liquid crystal display, reduction of power consumption can be aimed at by reducing the count of the charge and discharge of a signal line which drive a pixel and a pixel.

[0010] Since a pixel serves as a capacitive component in the case of a liquid crystal display, compared with the case where attenuation of brightness is CRT, it is late. Therefore, even if it drops drive frequency, it is possible to maintain long duration brightness and such an actuation approach is effective in a still picture. Moreover, the number of a film of top delivery of a hit of 1 second is 24, and 60Hz drive frequency is superfluous also from the point of animation playback. However, if a frequency is dropped on a current liquid crystal actuation method, synchronizing with renewal of data, the polarity-reversals frequency of liquid crystal will also become late, and the brightness deflection of forward and negative polarity will be checked by looking as a flicker.

[0011] Although what is necessary is just to continue impressing direct current voltage to liquid crystal in order to drop drive frequency and to lose a flicker, as mentioned above in this case, the property of liquid crystal deteriorates. Then, most pixels impress the same electrical potential difference as last time at the time of renewal of data, carry out the polarity reversals of some pixels, and should just drop the reversal frequency to the range where liquid crystal does not deteriorate. Since a flicker stops occurring, a frequency can be dropped on making it such an actuation approach, since the pixel to invert also decreases further, the amount of charges and discharges also becomes less, and reduction-ization of power consumption is attained.

[0012] Only the polarity written in the pixel electrode of the part corresponding to a part of scanning lines among the whole screen area as an approach of solving this problem is reversed, and the false DC actuation method which impresses the electrical potential difference of the time of the scan at the time of the last image display and like-pole nature to the pixel electrode of the part corresponding to the other scanning line is proposed. (For example, refer to JP,10-133176,A)

Drawing 13 is drawing for explaining an example of such a false DC actuation method. Drawing 13 (a) is drawing corresponding to the image of the 1st frame in time of day t0-t1. Drawing 13 (b) is drawing corresponding to the image of the 2nd frame in the time of day t1-t2 which is a frame next to the 1st frame. Drawing 13 (c) is drawing corresponding to the image of the 3rd frame in time of day t2-t3, and drawing 13 (d) is drawing corresponding to the image of the 4th frame in time of day t3-t4.

[0013] In the time of day t0 or before, the signal of straight polarity is held at the pixel section corresponding to the 1st - the 4th scanning line, and drawing 13 (a) shows that the signal of negative polarity is held to the pixel section corresponding to the 5th - the k-th scanning line. And in time of day t0-t1, sequential selection of the 1st - every k-th one scanning line is made, and the image of the 1st frame is updated. That is, as shown in drawing 13 (a), the signal of straight polarity is written in the pixel section corresponding to the 1st - the 5th scanning line, and the signal of negative polarity is written in the pixel section corresponding to the 6th - the k-th scanning line. Therefore, in time of day t0-t1, the polarity of the signal which the pixel section corresponding to the 5th scanning line holds is reversed from negative polarity to straight polarity.

[0014] Drawing 13 (b) shows that the signal of straight polarity is written in the pixel section corresponding to the 1st - the 6th scanning line, and the signal of negative polarity is written in the pixel section corresponding to the 7th - the k-th scanning line in the time of the 2nd-frame image display. Therefore, in time of day t1-t2, the polarity of the signal which the pixel section corresponding to the 6th scanning line holds is reversed from negative polarity to straight polarity. Drawing 13 (c) shows that the signal of straight polarity is written in the pixel section corresponding to the 1st - the 7th scanning line, and the signal of negative polarity is written in the pixel section corresponding to the 8th - the k-th scanning line in the time of the 3rd-frame image display. Therefore, in time of day t2-t3, the polarity of the signal which the pixel section corresponding to the 7th scanning line holds is reversed from negative polarity to straight polarity.

[0015] Drawing 13 (d) shows that the signal of straight polarity is written in the pixel section corresponding to the 1st - the 8th scanning line, and the signal of negative polarity is written in the pixel section corresponding to the 9th - the k-th scanning line in the time of the 4th-frame image display. Therefore, in time of day t3-t4, the polarity of the signal which the pixel section corresponding to the 8th scanning line holds is reversed from negative polarity to straight polarity. That is, a false DC actuation method is a

method which is made to reverse only the polarity of the signal which the pixel corresponding to a part of scanning lines of all the scanning lines holds, and impresses the signal of the time of a scan, and like-pole nature to the pixel section on the other scanning line last time. drawing 13 (a) - one screen (image of one frame) is updated in the example shown by 16 (d) -- ** -- be alike, shift at a time the one scanning line corresponding to the pixel section which changes a polarity, and pass k renewal of a screen (renewal of a frame) -- the polarity of the signal which all the pixel sections of a liquid crystal panel hold is reversed.

[0016]

[Problem(s) to be Solved by the Invention] When deflection appeared between the forward electrical potential difference impressed to a pixel electrode by the upper and lower sides of a screen bordering on the scanning line which performed the polarity reversals of what can prevent a flicker of a screen, and the negative electrical potential difference and the false DC actuation approach which was mentioned above set the brightness corresponding to Lp and a negative electrical potential difference for the brightness corresponding to a forward electrical potential difference to Lm, the brightness difference had the trouble of being checked by looking as |Lp-Lm|. This invention aims at offering the liquid crystal display which can make the brightness difference in the display screen by the scanning line which performed polarity reversals mitigate further, and its actuation approach while it can prevent a flicker of a screen, and degradation of liquid crystal.

[0017]

[Means for Solving the Problem] While the liquid crystal display concerning this invention chooses a sequential-scanning line from the liquid crystal panel with which two or more scanning lines and signal lines carried out [each-other] the crossover, and were prepared, and the pixel electrode was formed in each intersection in the shape of a matrix, and two or more scanning lines The polar signal of either straight polarity or negative polarity is given to two or more signal lines, and it has the screen actuation control section which carries out actuation control of the image displayed on the screen of a liquid crystal panel. A screen actuation control section While making into the polarity-reversals field of a pixel electrode the image field which consists of two or more continuous scanning lines and making the polarity of reverse reverse the polarity of the pixel electrode of the predetermined scanning line in the polarity-reversals field of a pixel electrode with the polarity at the time of a scan last time for every frame scanning It moves the 1 scanning line of polarity-reversals fields of a pixel electrode at a time.

[0018] Moreover, the predetermined scanning line of the liquid crystal display concerning this invention is characterized by being all the scanning lines in the polarity-reversals field of a pixel electrode.

[0019] Moreover, the polarity-reversals field of the pixel electrode of the liquid crystal display concerning this invention is characterized by the adjoining thing for which the polarity is changed for every scanning line.

[0020] Moreover, the screen actuation control section of the liquid crystal display concerning this invention controls the polarity of the pixel electrode of the scanning line of the up field of a screen, and a lower field further to become a mutually different polarity, when the polarity-reversals field of a pixel electrode is in the staging area of a screen.

[0021] Moreover, while the liquid crystal display concerning this invention chooses a sequential-scanning line from the liquid crystal panel with which two or more scanning lines and signal lines carried out [each-other] the crossover, and were prepared, and the pixel electrode was formed in each intersection in the shape of a matrix, and two or more scanning lines The polar signal of either straight polarity or negative polarity is given to two or more signal lines, and it has the screen actuation control section which carries out actuation control of the image displayed on the screen of a liquid crystal panel. A screen actuation control section Make into the polarity-reversals field of a pixel electrode the image field which consists of two or more continuous scanning lines, and it sets to the polarity-reversals field of a pixel electrode. While reversing the polarity of the pixel electrode of the predetermined scanning line the scan period more than a frame-scanning period, reversing the polarity of the pixel electrode of the scanning line which remains and making the polarity of reverse reverse the polarity at the time of a scan last time for every frame scanning, it moves the 1 scanning line of polarity-reversals fields of a pixel electrode at a time for every frame scanning.

[0022] Moreover, the predetermined scanning line of the liquid crystal display concerning this invention is characterized by being two or more scanning lines chosen every other in the polarity-reversals field of a pixel electrode.

[0023] Moreover, the predetermined scanning line of the liquid crystal display concerning this invention is characterized by being the one scanning line of eye predetermined watch.

[0024] Moreover, while the liquid crystal display concerning this invention chooses a sequential-scanning line from the liquid crystal

panel with which two or more scanning lines and signal lines carried out [each other] the crossover, and were prepared, and the pixel electrode was formed in each intersection in the shape of a matrix, and two or more scanning lines The polar signal of either straight polarity or negative polarity is given to two or more signal lines, and it has the screen actuation control section which carries out actuation control of the image displayed on the screen of a liquid crystal panel. A screen actuation control section When the image field which consists of two or more continuous scanning lines is made into the polarity-reversals field of a pixel electrode and the polarity-reversals field of a pixel electrode is in the staging area of a screen, While controlling the polarity of the pixel electrode of the scanning line of the up field of a screen, and a lower field to become a mutually different polarity It constitutes from the scanning line which reverses a polarity for the polarity-reversals field of a pixel electrode for every scan, and the scanning line which reverses a polarity spacing more than a scan period. The polar ratio of the pixel occupied in the polarity-reversals field of a pixel electrode is made to correspond to the polarity of an up field and a lower field between an up field and a lower field, and is increased or decreased, and it moves the 1 scanning line of polarity-reversals fields of a pixel electrode at a time for every frame scanning.

[0025] Moreover, the actuation approach of the liquid crystal display concerning this invention makes the image field which consists of two or more continuous scanning lines the polarity-reversals field of a pixel electrode, and it moves the 1 scanning line of polarity-reversals fields of a pixel electrode at a time while the polarity at the time of a scan makes the polarity of reverse reverse the polarity of the pixel electrode of the predetermined scanning line in the polarity-reversals field of the above-mentioned pixel electrode last time for every frame scanning.

[0026] Moreover, the actuation approach of the liquid crystal display concerning this invention Make into the polarity-reversals field of a pixel electrode the image field which consists of two or more continuous scanning lines, and it sets to the polarity-reversals field of a pixel electrode. While reversing the polarity of the pixel electrode of the predetermined scanning line the scan period more than a frame-scanning period, reversing the polarity of the pixel electrode of the scanning line which remains and making the polarity of reverse reverse the polarity at the time of a scan last time for every frame scanning, it moves the 1 scanning line of polarity-reversals fields of a pixel electrode at a time for every frame scanning.

[0027] Moreover, the actuation approach of the liquid crystal display concerning this invention When the image field which consists of two or more continuous scanning lines is made into the polarity-reversals field of a pixel electrode and the polarity-reversals field of a pixel electrode is in the staging area of a screen, While controlling the polarity of the pixel electrode of the scanning line of the up field of a screen, and a lower field to become a mutually different polarity It constitutes from the scanning line which reverses a polarity for the polarity-reversals field of a pixel electrode for every scan, and the scanning line which reverses a polarity spacing more than a scan period. The polar ratio of the pixel occupied in the polarity-reversals field of the above-mentioned pixel electrode is made to correspond to the polarity of an up field and a lower field between an up field and a lower field, and is increased or decreased, and it moves the 1 scanning line of polarity-reversals fields of the above-mentioned pixel electrode at a time for every frame scanning.

[0028]

[Embodiment of the Invention] Hereafter, the gestalt of 1 operation of this invention is explained based on a drawing. In addition, it is shown that the thing of the same sign as the former is the same as that of the conventional thing or considerable.

Gestalt 1. drawing 1 of operation is the perspective view showing notionally the outline configuration of the liquid crystal display of this invention. In drawing 1 , the light source for the screen actuation control section which performs control for the whole liquid crystal display and 2 to display a liquid crystal panel (for example, TFT liquid crystal panel), and for 3 display the image of a liquid crystal panel 2, as for 1, and 4 to irradiate light from the back of a liquid crystal panel 2 to a liquid crystal panel 2, and 5 are the light source actuators for driving the light source 4.

[0029] A liquid crystal panel 2 consists of two transparent substrates, such as glass, and liquid crystal is enclosed among them. And the switching element (for example, TFT) for turning on and off the pixel electrode transparent to one sheet (array substrate) and pixel electrode of a glass substrate is formed, a transparent counterelectrode is formed at other glass substrates (opposite substrate), and liquid crystal is inserted inter-electrode. And it has the composition that an electrical potential difference is applied to inter-electrode corresponding to each pixel. In addition, on an array substrate, a counterelectrode may adjoin a pixel electrode and may be prepared.

[0030] Drawing 2 is the block diagram showing the outline configuration of the liquid crystal panel 2 in drawing 1 , and the screen actuation

control section 3. The display-control circuit 10 where the screen actuation control section 3 outputs a control signal PINV, and S1 and S2 in response to clock signal CLOCK, Horizontal Synchronizing signal HSYNC, and Vertical Synchronizing signal VSYNC as shown in drawing, The inverting circuit 11 which receives a video signal VIN, follows a control signal PINV, is made to reverse or rotate the polarity of a video signal VIN normally, and outputs a signal VIN2, It consists of an X driver 12 which receives a signal VIN2 and a control signal S1, and a Y driver 15 which receives a control signal S2 from the display-control circuit 11. Moreover, it is shown that a signal line drives the liquid crystal panel 2 for displaying an image by the X driver 12, and the scanning line drives it by the Y driver 15.

[0031] The X driver 12 includes the shift register 13 which carries out a sequential shift in response to the control signal S1 which the display-control circuit 10 outputs based on a clock signal and a synchronizing signal, and the sample hold circuit 14 which incorporates the signal VIN2 corresponding to each signal line, and is held based on the output of a shift register 13. The Y driver 15 chooses the scanning line in response to the control signal S2 which the display-control circuit 10 outputs based on a horizontal and vertical synchronizing signal. In addition, in drawing 2 , in order to simplify explanation of this invention of operation, the liquid crystal panel 2 which is the display-panel section shows as an example the configuration containing the pixel section of 16x20 controlled by the scanning lines L1-L16 and signal lines D1-D20.

[0032] Drawing 3 is the representative circuit schematic having expanded and shown some liquid crystal panels 2. As shown in drawing 3 , on the array substrate of a liquid crystal panel 2, the signal lines D1-D3 which intersect perpendicularly with the scanning lines L1-L3 arranged in parallel with an one direction, and give the signal corresponding to image data to the pixel section are formed. The pixel section 21 is formed in the intersection of these scanning lines and signal lines. Including the counterelectrode 27 with which each pixel section 21 is formed on the pixel electrode 28 and an opposite substrate, liquid crystal is inserted between the pixel electrode 28 and the counterelectrode 27, and the capacitor 26 is formed.

[0033] Each pixel section 21 contains further the switching element prepared corresponding to an intersection with each scanning line. Drawing 3 R> 3 shows the example which contains TFT22 as a switching element. The gate electrode 25 of TFT22 is connected to the corresponding scanning line, the drain electrode 23 of TFT22 is connected to a corresponding signal line, and the source electrode 24 of TFT is connected to the pixel electrode 22. Although retention volume (it is also called storage capacitance) may be prepared in a capacitor 26 and juxtaposition in order to increase the signal holding time of a capacitor 26, it does not illustrate here.

[0034] With reference to drawing 2 and drawing 3 , the fundamental actuation used as the base of the liquid crystal display concerning this invention is explained briefly. Every one of the 16 scanning lines L1-L16 is chosen one by one by the Y driver 15. From the sample hold circuit 14 included in the X driver 12 synchronizing with selection of the scanning line, a signal is sent to the pixel section corresponding to each scanning line through signal lines D1-D20, and those signals are held with termination of the scanning line at each capacitor 26. Thus, each pixel is updated and a screen is updated. In addition, the configuration of the liquid crystal display explained using drawing 1 R> 1 · drawing 3 is similarly used in the gestalt 5 of the gestalt 2 of the operation explained later · operation.

[0035] By the liquid crystal display by the gestalt 1 or its actuation approach of this operation The image field which consists of two or more scanning lines (M) which continue in the image of one frame which consists of the k scanning lines is made into the polarity-reversals field of a pixel electrode. While carrying out sequential reversal of the electrode polarity of each scanning line for every scanning line to the electrode polarity of the scanning line in front of the time of a scan, and one in the polarity-reversals field of this pixel electrode last time It is characterized by carrying out actuation control of the liquid crystal panel so that it may move the 1 scanning line of polarity-reversals fields of the pixel electrode at a time for every frame scanning.

[0036] In order to simplify explanation of invention by the gestalt of this operation, concrete explanation is given using drawing 4 and drawing 5 R> 5 about the case where the screen of one frame consists of the 16 scanning lines (namely, K= 16). Drawing 4 is drawing for explaining signs that the scanning line is chosen on the screen of the liquid crystal display in the gestalt 1 of operation, and the scanning line which constitutes the image of one frame is 16 of L1-L16. In addition, drawing 4 is used also as drawing for explaining signs that the scanning line is chosen on the screen of the liquid crystal display in the gestalten 2-4 of operation mentioned later.

[0037] Moreover, drawing 5 is drawing for explaining the condition of the actuation sequence of the scanning line, and the polarity reversals of a pixel electrode in the liquid crystal display in a

gestalt 1 or its actuation approach of operation, and the number of 1-16 which are given to drawing is a number of the scanning line. Furthermore, drawing 5 shows the picture signal and selection time amount which are updated by the horizontal scanning time basis (1H) according to time series. Now, let the image field located in the lower part of a staging area and a screen in the image field located in an up field and the middle-of-the-screen section in the image field located in the upper part of the screen displayed as the image of the 1st frame in the period of time of day t0-t1 is shown in drawing 4 be a lower field.

[0038] First, as shown in drawing 5 (a), in the first image (namely, image of the 1st frame in the period of time of day t0-t1), sequential selection of every one scanning line is made in the up field of a screen at the order of the 1st, 2nd, 3rd, 4th, and 5th scanning line. And the pixel of the 1st - the 4th scanning line is the same polarity as the time of a scan (namely, image of the frame in front of [of the 1st frame] one) last time, for example, straight polarity is written in, and the straight polarity as the pixel of the 1st - the 4th scanning line with the same pixel of the 5th scanning line which was negative is written in last time at the time of a scan (at namely, the time of frame scanning before one).

[0039] In the staging area of the middle-of-the-screen section, the one scanning line is chosen at a time one by one in the 6th, 7th, 8th, 9th, 10th, and 11th order, and the polarity is reversed for every scanning line. Namely, the polarity of the pixel of the 6th scanning line is reversed from the straight polarity at the time of a scan to negative polarity last time. The polarity of the pixel of the 7th scanning line hereafter the polarity of the pixel of the 8th scanning line from negative polarity to straight polarity from straight polarity to negative polarity To straight polarity, the polarity of the pixel of the 9th scanning line the polarity of the pixel of the 11th scanning line for the polarity of the pixel of the 10th scanning line from negative polarity to the negative polarity from straight polarity from negative polarity to straight polarity With the time of a scan, the polarity which the polarity reversed and was reversed also to the polarity of the scanning line in front of one is written in one by one last time for every scanning line. namely, the 6- the field which consists of the six scanning lines with which the 11th continues is equivalent to the polarity-reversals field of the above-mentioned pixel electrode in the image of the 1st frame.

[0040] In the lower field of a screen, the one scanning line is chosen at a time one by one in the 12th, 13th, 14th, 15th, and 16th order, and the same straight polarity as the time of a scan is written in last time. thus, by the image of the 1st frame in the period of time of day t0-t1 As for all the polarities of the pixel of the 1st in the up field of a screen - the 5th scanning line, the same straight polarity is written in. As for the polarity of the pixel of the 6th in a staging area - the 11th scanning line (namely, scanning line of the polarity-reversals field of a pixel electrode), with the pixel polarity of the scanning line in front of the time of a scan, and one, the reversed polarity is written in last time. As for all the polarities of the pixel of the 12th in a lower field - the 16th scanning line, the same straight polarity as the scanning line of an up field is written in.

[0041] As shown in drawing 5 (b), by the following image (namely, image of the 2nd frame in the period of time of day t1-t2), the one scanning line is chosen at a time in the up field of a screen in the 1st, 2nd, 3rd, 4th, 5th, and 6th order. The same straight polarity as the time of a scan is written in last time, and, as for the pixel of the 1st - the 5th scanning line, the straight polarity as the 1st - the 5th scanning line with the same pixel of the 6th scanning line is written in. That is, in the screen up field of the image of the 2nd frame, the field where the same straight polarity as the time of a scan is written in last time spreads from a before image (image of the 1st frame in front of one) to the 6th scanning line under one.

[0042] The scanning line in the staging area of a screen in the 7th, 8th, 9th, 10th, 11th, and 12th order One is chosen at a time one by one, and the polarity which reversed the pixel polarity of the scanning line in front of the time of a scan and one is written in last time like the case of the 1st frame. The field (namely, polarity-reversals field of a pixel electrode) the polarity of a pixel electrode carries out [a field] sequential reversal for every scanning line moves to the 7th - the 12th scanning line from the 6th - the 11th scanning line. That is, in the image of the 2nd frame, only scanning-line 1 duty is moving down the screen in the polarity-reversals field of a pixel electrode from the polarity-reversals field of the pixel electrode at the time of a before image (frame image in front of one). In the lower field of a screen, the one scanning line is chosen at a time one by one in the 13th, 14th, 15th, and 16th order, and the same straight polarity as the time of a scan is written in last time. That is, the one scanning line of the field where the same straight polarity as the time of a scan is written in last time in the lower field of the screen of the image of the 2nd frame becomes less than a before image (frame image in front of one), and it is narrow.

[0043] Next, as shown in drawing 5 (c), in the up field of the image of the 3rd frame in the period of time of day t2-t3, the one scanning line is chosen

at a time in the 1st, 2nd, 3rd, 4th, 5th, 6th, and 7th order. the same straight polarity as the time of a scan writes in the pixel of the 1st · the 6th scanning line last time -- having -- the pixel of the 7th scanning line -- the 1· the same straight polarity as the 6th is written in. That is, the up field of the image of the 3rd frame spreads from a before image (namely, image of the 2nd frame) to the scanning line under one (the 7th scanning line).

[0044] In a staging area, the one scanning line is chosen at a time one by one in the 8th, 9th, 10th, 11th, 12th, and 13th order, last time, with the pixel polarity of the scanning line in front of the time of a scan, and one, the reversed polarity is written in and the field (namely, polarity-reversals field of a pixel electrode) the polarity of a pixel electrode carries out [a field] sequential reversal for every scanning line moves. That is, it is moving to the scanning line under one (the 8th scanning line) in the polarity-reversals field of the pixel electrode of the image of the 3rd frame from the polarity-reversals field of the pixel electrode at the time of a before image (image of the 2nd frame in front of one). In the lower field of a screen, the one scanning line is chosen at a time one by one in the 14th, 15th, and 16th order, and the same polarity as the time of a scan is written in last time. That is, the one scanning line of the lower field of the image of the 3rd frame becomes less than a before image (image of the 2nd frame in front of one), and it is narrow.

[0045] thus, the liquid crystal display by the gestalt 1 or its actuation approach of this operation -- setting -- an image -- an one frame ** -- whenever it ******, when the 1 scanning line moves at a time to a screen lower part, the polarity reversals field of the pixel electrode which consisted of the six scanning lines, for example goes and the 16th Motome scanning line is exceed, as showed in drawing 5 (d), the polarity reversals field of a pixel electrode will divide and exist in the up field and the lower field of a screen. By doing in this way, since it charges with the same polar direct current voltage, a flicker does not generate the pixel of the scanning line in image fields other than the polarity-reversals field of a pixel electrode. Moreover, since it is lost to the pixel electrode of the one scanning line by always moving the polarity-reversals field of the pixel electrode which consisted of two or more scanning lines that the same forward or negative polar electrical potential difference is impressed for a long time, liquid crystal degradation can be prevented in the whole screen.

[0046] By the way, if the brightness corresponding to Lp and a negative electrical potential difference for the brightness corresponding to a forward electrical potential difference is set to Lm when charging a pixel with direct current voltage, the image side of the up field of a screen and a lower field will serve as Lp or Lm. Generally, since the resolution of human being's eyes is larger than the scanning line, the brightness of the image side of the polarity-reversals field of a pixel electrode is set to (Lp+Lm)/2. Therefore, in the liquid crystal display by the gestalt 1 of this operation, a brightness difference becomes | (Lp-Lm) / 2| of the one half of the conventional example.

[0047] That is, according to the gestalt 1 of this operation, a flicker does not occur on a screen but the outstanding effectiveness that the brightness difference by the scanning line which can prevent the whole liquid crystal degradation upwards and performed polarity reversals further is also mitigable is done so. In addition, although the gestalt 1 of this operation showed the case where only one field prepared a pixel electrode polarity-reversals field on the display screen, even if it prepares more than one, there is same effectiveness. Moreover, although the gestalt 1 of this operation showed the case where the polarity of the pixel electrode of the scanning line of fields other than a pixel electrode polarity-reversals field was straight polarity, there is effectiveness same also as negative polarity.

[0048] Gestalt 2. drawing 6 of operation is drawing for explaining the condition of the polarity reversals of the sequence (actuation sequence) which chooses the scanning line, and a pixel electrode in the liquid crystal display in a gestalt 2 or its actuation approach of operation. In addition, suppose that drawing 4 used by explanation of the gestalt 1 of operation is referred to as drawing for explaining signs that the scanning line is chosen on the screen of the liquid crystal display in the gestalt 2 of operation. When the polarity-reversals field of a pixel electrode is in the staging area of a screen, the gestalt of this operation is characterized by to carry out actuation control of the liquid crystal panel so that it may become reversed polarity mutually about the polarity of the up field of a screen, and a lower field, and is further characterized in the gestalt 1 of operation mentioned above by to carry out actuation control of the liquid crystal panel so that a screen may be reversed for the polarity of the up field of a screen, and a lower field to predetermined timing.

[0049] Hereafter, invention by the gestalt of this operation is explained based on drawing 4 and drawing 6 . In drawing 4 and drawing 6 , one to 16 number given to drawing is a scanning-line number. Now, let the image field located in the lower part of a staging area and a screen in the image field located in an up field and the

middle-of-the-screen section in the image field located in the upper part of a screen as the image of the 1st frame in the period of time of day t0-t1 is shown in drawing 4 be an up field. First, as shown in drawing 6 (a), by the first image (namely, image of the 1st frame in the period of time of day t0-t1), as for the up field of a screen, sequential selection of every one scanning line is made at the order of the 1st, 2nd, 3rd, 4th, and 5th scanning line.

[0050] And as for the pixel of the 1st - the 4th scanning line, the last time same straight polarity as the time of a scan (namely, image of the frame in front of one of the image of the 1st frame) is written in, and the straight polarity as the 1st - the 4th scanning line with the same pixel of the 5th scanning line which was negative polarity at the time of a scan is written in last time. Namely, as for all the pixels of the 1st - the 5th scanning line of the image of the 1st frame, the same straight polarity is written in.

[0051] The scanning line in the staging area of the middle-of-the-screen section in the 6th, 7th, 8th, 9th, 10th, and 11th order One is chosen at a time one by one. The pixel electrode of the 6th scanning line from straight polarity to the negative-electrode forward The pixel electrode of the 7th scanning line the pixel electrode of the 8th scanning line from negative polarity to the positive-electrode forward from straight polarity to the negative-electrode forward The pixel electrode of the 9th scanning line the pixel electrode of the 11th scanning line from negative polarity for the pixel electrode of the 10th scanning line to the positive-electrode forward the negative-electrode forward from straight polarity from negative polarity to the positive-electrode forward With the time of a scan, the polarity which the polarity reversed and was reversed also to the polarity of the scanning line in front of one is written in one by one last time for every scanning line.

[0052] namely, the 6- the image field which consists of the six scanning lines with which the 11th continues is equivalent to the polarity-reversals field of the pixel electrode explained with the gestalt 1 of operation. In the lower field of a screen, the one scanning line is chosen at a time one by one in the 12th, 13th, 14th, 15th, and 16th order, the polarity of the pixel electrode of the 1st - the 5th scanning line of an up field is negative-electrode forward [of reverse], and the same negative polarity as the time of a scan is written in last time.

[0053] Next, as shown in drawing 6 (b), by the following image (namely, image of the 2nd frame of time of day t1-t2), the one scanning line is chosen at a time in the up field of a screen in the 1st, 2nd, 3rd, 4th, 5th, and 6th order. the same straight polarity as the time of a scan writes in the pixel of the 1st - the 5th scanning line last time -- having -- the pixel of the 6th scanning line -- the 1- the same straight polarity as the 5th is written in. That is, the up field of a screen spreads from a before image to the scanning line under one (the 6th scanning line).

[0054] The scanning line in the staging area of the middle-of-the-screen section in the 7th, 8th, 9th, 10th, 11th, and 12th order The field as for which one is chosen one by one at a time, the polarity is reversed for every scanning line, and the polarity of a pixel electrode carries out sequential reversal to the polarity of the scanning line in front of the time of a scan, and one last time for every scanning line (Namely, the polarity-reversals field of a pixel electrode) moves to the field of the 7th - the 12th scanning line from the field of the 6th - the 11th scanning line. That is, also in the gestalt of this operation, it is moving in the polarity-reversals field of the pixel electrode of the image of the 2nd frame to the field under the one scanning line (the 7th - the 12th scanning line) from the polarity-reversals field (the 6th - the 11th scanning line) of the pixel electrode at the time of a before image (image of the 1st frame).

[0055] In the lower field of a screen, the one scanning line is chosen at a time one by one in the 13th, 14th, 15th, and 16th order, the polarity (namely, straight polarity) of the pixel electrode of the scanning line of the up field of a screen is the polarity of reverse, and the same negative polarity as the time of a scan is written in last time. That is, the one scanning line of the field where the same negative polarity as the time of a scan is written in last time in the lower field of the screen of the image of the 2nd frame becomes less than a before image (frame image in front of one), and it is narrow.

[0056] Henceforth, as it moves to the up field of a screen from a part of polarity-reversals field of the pixel electrode after the polarity-reversals field of a pixel electrode moving toward the direction of a bottom of screen the 1 every scanning line whenever the image of one frame is updated, and running to the 16th lowermost scanning line, it moves further toward the screen upper part to the lower part and it is shown in a number of frames or the back at drawing 6 (c), the polarity-reversals field of a pixel electrode is moved to the staging area of a screen. At this time, the polarity of the up field of a screen and a lower field is reversed. That is, that it was negative polarity is making the negative-electrode forward reverse [polarity / of the pixel electrode of the scanning line of the up field of a screen / polarity / straight polarity and / of the pixel electrode of the scanning line of a lower field] a polarity to straight polarity in a

lower field in an up field in drawing 6 R> 6 (c) at the time of drawing 6 (a) or drawing 6 (b).

[0057] That is, with the gestalt of this operation, since several K of the scanning line which constitutes the image of one frame is 16, whenever a screen is updated 16 times, the polarity of the pixel electrode of the scanning line of an up field and a lower field will be reversed. In addition, there may not be timing by which the polarity of the pixel electrode of the scanning line of an up field and a lower field is reversed then, whenever a screen is updated 16 times, and it may be the predetermined timing for every Kxm (m is forward integer) times, such as 32 times and 48 etc. times.

[0058] After reversing the polarity of the up field of a screen, and a lower field, as shown in drawing 6 (c), in the up field of a screen, the one scanning line is chosen at a time in the 1st, 2nd, 3rd, 4th, and 5th order. the last time same negative polarity as the time of a scan writes in the pixel of the 1st - the 4th scanning line -- having -- the pixel of the 5th scanning line -- the 1- the same negative polarity as the 4th is written in. That is, the up field of a screen spreads from a before image to the scanning line under one (the 5th scanning line).

[0059] In a staging area, the one scanning line is chosen at a time one by one in the 6th, 7th, 8th, 9th, 10th, and 11th order, the polarity is reversed for every scanning line, and the polarity-reversals field of a pixel electrode moves. The one scanning line is chosen at a time one by one in the 12th, 13th, 14th, 15th, and 16th order, and a lower field has it, and the same straight polarity as the time of a scan is written in last time. [contrary to the polarity of an up field] In addition, drawing 6 (d) and drawing 6 R> 6 (e) show a condition in case the pixel electrode polarity-reversals field is divided into the up field and lower field of a screen, and drawing 6 (d) is an example thing about the condition in the middle of shifting to drawing 6 (c) from drawing 6 (b).

[0060] As explained above, by the liquid crystal display by the gestalt 2 or its actuation approach of this operation The image field which consists of two or more scanning lines (M) which continue in the image of one frame which consists of the k scanning lines is made into the polarity-reversals field of a pixel electrode. While carrying out sequential reversal of the electrode polarity of each scanning line for every scanning line to the electrode polarity of the scanning line in front of the time of a scan, and one in the polarity-reversals field of this pixel electrode last time While moving the 1 scanning line of polarity-reversals fields of the pixel electrode at a time for every frame scanning, when the polarity-reversals field of a pixel electrode is in the staging area of a screen, it is further characterized by driving a liquid crystal panel so that it may become reversed polarity mutually about the polarity of the up field of a screen, and a lower field. Furthermore, it is characterized by driving a liquid crystal panel so that a screen may reverse the polarity of the up field of a screen, and a lower field to the predetermined timing of ** by which renewal of a Kxm (K is the number of scanning lines of screen, and m is forward integer) time is carried out.

[0061] Thus, liquid crystal display ******** by the gestalt 2 of this operation is set to the actuation approach. the case of the gestalt 1 of operation -- the same -- an image -- an one-frame **, if the 1 scanning line moves at a time to a screen lower part, the polarity-reversals field of the pixel electrode which consisted of the six scanning lines, for example goes and the 16th Motome's scanning line is exceeded whenever it ****** The polarity-reversals field of a pixel electrode will divide and exist in the up field and lower field of a screen. By doing in this way, since it charges with the same polar direct current voltage, a flicker does not generate the pixel of the scanning line in image fields other than a pixel electrode polarity-reversals field. Moreover, since it is lost that the same forward or negative polar electrical potential difference is impressed to the pixel electrode of the one scanning line for a long time by always moving the polarity-reversals field of the pixel electrode which consisted of two or more scanning lines, liquid crystal degradation can be prevented in the whole screen.

[0062] Moreover, if the brightness corresponding to Lp and a negative electrical potential difference for the brightness corresponding to a forward electrical potential difference is set to Lm when charging a pixel with direct current voltage, the image side of the up field of a screen and a lower field will serve as Lp or Lm. Generally, since the resolution of human being's eyes is larger than the scanning line, the brightness of the image side of the polarity-reversals field of a pixel electrode is set to (Lp+Lm)/2. Therefore, like the case of the gestalt 1 of operation, also in the gestalt of this operation, a brightness difference becomes | (Lp-Lm) / 2| of the one half of the conventional example, and is mitigated.

[0063] Furthermore, since the positive/negative of an electrical potential difference which joins the whole pixel side of liquid crystal by making mutually into reversed polarity the polarity of the direct current voltage impressed to a pixel in the up field and lower field of a screen, and reversing a polarity by turns to predetermined timing can be balanced, it is effective in degradation of liquid crystal becoming less than the case of the gestalt 1 of operation further. In addition, although the

gestalt of this operation also showed the case where only one field prepared a pixel electrode polarity-reversals field on the display screen, even if it prepares more than one, it cannot be overemphasized that there is same effectiveness.

[0064] Gestalt 3. drawing 7 of operation is drawing for explaining the condition of the actuation sequence of the scanning line, and the polarity reversals of a pixel electrode in the liquid crystal display in a gestalt 3 or its actuation approach of operation. In addition, suppose that drawing 4 used by explanation of the gestalt 1 of operation is referred to as drawing for explaining signs that the scanning line is chosen on the screen of the liquid crystal display in the gestalt 3 of operation. With the gestalt of this operation, it is characterized by reversing the electrode polarity of the scanning line to the predetermined scanning line spacing more than a scan period (every [for example,] 2 scan periods) in the polarity-reversals field of the gestalt 1 of operation, or the pixel electrode of 2.

[0065] For example, as shown in drawing 7 , the pixel polarity of the scanning line corresponding to the viewing area of the upper part and a lower field is made into the same straight polarity as the time of a scan last time, the pixel polarity of the scanning line is changed at spacing for every 2 scan periods every other in a staging area (namely, polarity-reversals field of a pixel electrode), and the case where it moves the 1 scanning line of polarity-reversals fields of a pixel electrode at a time for every frame scanning is explained. First, by the first image (namely, image of the 1st frame in the period of time of day t0-t1), as shown in drawing 7 (a), as for the up field of a screen, sequential selection of every one scanning line is made at the order of the 1st, 2nd, 3rd, 4th, and 5th scanning line. the pixel of the 1st - the 4th scanning line is last time the same as that of the time of a scan, for example, straight polarity writes it in -- having -- last time -- the time of a scan -- negative polarity -- the pixel of the 5th scanning line of ****** -- the 1- the same straight polarity as the 4th is written in.

[0066] In the polarity-reversals field of the pixel electrode in the staging area of a screen, in the 6th, 7th, 8th, 9th, 10th, and 11th order, although the one scanning line is chosen at a time one by one As shown in drawing 7 (a), as for the pixel electrode of the 6th, 8th, and 10th scanning line, the same **** as the time of a scan is written in last time. As for the pixel electrode of the 7th, 9th, and 11th scanning line, with the time of a scan, **** of reversed polarity was written in last time, and the polarity has reversed the pixel electrode of the 6th, 8th, and 10th scanning line to the pixel electrode of the scanning line in front of one. That is, the pixel polarity is reversed for every 2 scan periods to the scanning line of an every other. In the lower field of a screen, the one scanning line is chosen at a time one by one in the 12th, 13th, 14th, 15th, and 16th order, and the same straight polarity as the time of a scan is written in last time.

[0067] As shown in drawing 7 (b), by the following image (namely, image of the 2nd frame in the period of time of day t1-t2), the one scanning line is chosen at a time in the up field of a screen in the 1st, 2nd, 3rd, 4th, 5th, and 6th order. the same straight polarity as the time of a scan writes in the pixel of the 1st - the 5th scanning line last time -- having -- the pixel of the 6th scanning line -- the 1- the same straight polarity as the 5th is written in. That is, the up field of a screen spreads from a before image to the scanning line under one (the 6th scanning line).

[0068] The scanning line in the staging area of a screen in the 7th, 8th, 9th, 10th, 11th, and 12th order One is chosen at a time one by one, and, as for the pixel electrode of the 7th, 9th, and 11th scanning line, the same **** as the time of a scan is written in last time like the case of the image of the 1st frame. With the time of a scan, **** of reversed polarity was written in last time, and the polarity has reversed [the pixel electrode of the 7th, 9th, and 11th scanning line] the pixel electrode of the 8th, 10th, and 12th scanning line to the pixel electrode of the scanning line in front of one. Moreover, also in the gestalt of this operation, it is moving in the polarity-reversals field of the pixel electrode of the image of the 2nd frame to the field (the 7th - the 12th scanning line) of the scanning line under one from the polarity-reversals field (the 6th - the 11th scanning line) of the pixel electrode at the time of the image of the 1st frame.

[0069] The one scanning line is chosen at a time one by one in the 13th, 14th, 15th, and 16th order, and, as for the lower field of a screen, the same polarity as the time of a scan is written in last time. As the following image (namely, image of the 2nd frame in the period of time of day t2-t3) shows to drawing 7 (c), in the field of the screen upper part, the one scanning line is chosen at a time in the 1st, 2nd, 3rd, 4th, 5th, 6th, and 7th order. the same straight polarity as the time of a scan writes in the pixel of the 1st - the 6th scanning line last time -- having -- the pixel of the 7th scanning line -- the 1- the same straight polarity as the 6th is written in. That is, as for the up field of a screen, the scanning line spreads from a before image to the scanning line under one (the 7th scanning line).

[0070] The scanning line in a staging area in the 8th, 9th, 10th, 11th, 12th, and 13th order One is chosen at a time one by one, and, as for the pixel

electrode of the 8th, 10th, and 12th scanning line, the same **** as the time of a scan is written in last time like the case of the image of the 2nd frame. The 9th, the 11th, the 13th With the time of a scan, **** of reversed polarity was written in last time, and the polarity has reversed [the pixel electrode of the 7th 9th, and 13th scanning line] the pixel electrode of the scanning line to the pixel electrode of the scanning line in front of one.

[0071] Moreover, it is moving in the polarity-reversals field of the pixel electrode of the image of the 3rd frame to the field (the 8th - the 13th scanning line) of the scanning line under one from the polarity-reversals field (the 7th - the 12th scanning line) of the pixel electrode at the time of the image of the 2nd frame. In the lower field of a screen, the one scanning line is chosen at a time one by one in the 14th, 15th, and 16th order, and the same polarity as the time of a scan is written in last time.

[0072] Thus, it sets to the liquid crystal display by the gestalt 3 of this operation. It consists of the six scanning lines, for example. an image -- an one-frame **, whenever it ****** If the polarity reversals of the every other three scanning lines are carried out every two scans, and the polarity-reversals field of the pixel electrode by which polarity reversals are carried out for every scan moves the 1 scanning line of electrode polarities of the three scanning lines which remain at a time to a screen lower part, it goes among those and the 16th Motome's scanning line is exceeded As shown in drawing 7 (d), the polarity-reversals field of a pixel electrode will divide and exist in the up field and lower field of a screen.

[0073] By doing in this way, like the gestalt 1 of operation, or the case of 2, since it charges with the same polar direct current voltage, a flicker does not generate the pixel of the scanning line in image fields other than the polarity-reversals field of a pixel electrode. Moreover, since it is lost to the pixel electrode of the one scanning line by always moving the polarity-reversals field of the pixel electrode which consisted of two or more scanning lines that the same forward or negative polar electrical potential difference is impressed for a long time, liquid crystal degradation can be prevented in the whole screen. Furthermore, since the frequency of the polarity reversals of the pixel electrode in the polarity-reversals field of a pixel electrode becomes low, it is effective in the ability to reduce the power consumption of the circuit (namely, screen actuation control section 3) which drives the liquid crystal panel 2 with a capacitive load rather than the case where it is the gestalt 1 of operation, or 2.

[0074] In addition, also with the gestalt of this operation, although 1 field ****** case was shown on the display screen, even if it prepares two or more polarity-reversals fields of a pixel electrode, there is same effectiveness. Moreover, although the case where the polarity of the pixel of the scanning lines other than the polarity-reversals field of a pixel electrode was straight polarity was explained, it is good also as a polarity in which may be negative polarity or the up field of a screen differs mutually from a lower field.

[0075] Gestalt 4. drawing 8 of operation is drawing for explaining the condition of the polarity reversals of the sequence (actuation sequence) which chooses the scanning line, and a pixel electrode in the liquid crystal display in the gestalt 4 of operation. In addition, suppose that drawing 4 used by explanation of the gestalt 1 of operation is referred to as drawing for explaining signs that the scanning line is chosen on the screen of the liquid crystal display in the gestalt 3 of operation. Although the electrode polarity was reversed to the scanning line of an every other spacing more than a scan period (every [for example,] 2 scan periods) in the polarity-reversals field of the pixel electrode in the gestalt 3 of the above-mentioned operation By carrying out the polarity reversals only of the scanning line of eye predetermined watch of the polarity-reversals field of a pixel electrode spacing more than a scan period (for example, 2 scan periods), and carrying out polarity reversals for every scan in invention by the gestalt of this operation, to the scanning line which remains It is characterized by shortening the mean wave period of the polarity reversals in a polarity-reversals field compared with the case of the gestalt 3 of operation.

[0076] Hereafter, invention by the gestalt of this operation is explained based on drawing 4 and drawing 8 . First, as the first image (namely, image of the 1st frame in time of day t0 - time of day t1) is shown in drawing 8 (a), as for the up field of a screen, sequential selection of every one scanning line is made at the order of the 1st, 2nd, 3rd, 4th, and 5th scanning line. The pixel of the 1st - the 4th scanning line is last time the same as that of the time of a scan, for example, straight polarity is written in, last time, it is reversed that it was negative polarity at the time of a scan, and, as for the pixel of the 5th scanning line, the same straight polarity as the 1st - the 4th scanning line is written in.

[0077] In the polarity-reversals field of the pixel electrode in the staging area of a screen, the 6th, 7th, 9th, 10th, and 11th one scanning line is chosen at a time one by one, and, as for the pixel of each scanning line, the same polarity as the time of a scan is written only for the pixel on the 8th scanning line whose polarity of pair Perilla

frutescens (L.) Britton var. crispa (Thunb.) Decne. is the scanning line which it is reversed and is the 3rd of the polarity-reversals field of a pixel electrode in the pixel polarity at the time of a scan last time. In the lower field of a screen, the one scanning line is chosen at a time one by one in the 12th, 13th, 14th, 15th, and 16th order, and the same straight polarity as the time of a scan is written in last time.

[0078] As the following image of the 2nd frame shows to drawing 8 (b), in the up field of a screen, the one scanning line is chosen at a time in the 1st, 2nd, 3rd, 4th, 5th, and 6th order. the same straight polarity as the time of a scan writes in the pixel of the 1st - the 5th scanning line last time -- having -- the pixel of the 6th scanning line -- the 1- the same straight polarity as the 5th is written in. That is, as for the up field of a screen, the scanning line spreads from a before image to the scanning line under one (the 6th scanning line).

[0079] In the polarity-reversals field of the pixel electrode in the staging area of a screen, one pixel on the 7th, the 8th, the 10th, the 11th, and the 12th scanning line is chosen at a time for the scanning line one by one, the polarity of pair Perilla frutescens (L.) Britton var. crispa (Thunb.) Decne. is reversed last time by the pixel polarity at the time of a scan, and the same polarity as the time of a scan is written in only for the pixel on the 9th scanning line which is the 3rd scanning line in the polarity-reversals field of a pixel electrode last time. And also in the gestalt of this operation, it is moving in the polarity-reversals field of the pixel electrode of the image of the 2nd frame to the field (the 7th - the 12th scanning line) of the scanning line under one from the polarity-reversals field (the 6th - the 11th scanning line) of the pixel electrode at the time of the image of the 1st frame.

[0080] In the lower field of a screen, the one scanning line is chosen at a time one by one in the 13th, 14th, 15th, and 16th order, and the same straight polarity as the time of a scan is written in last time. As the following image of the 3rd frame shows to drawing 8 (c), in the field of the screen upper part, the one scanning line is chosen at a time in the 1st, 2nd, 4th, 5th, 6th, and 7th order. the same straight polarity as the time of a scan writes in the pixel of the 1st - the 6th scanning line last time -- having -- the pixel of the 7th scanning line -- the 1- the same straight polarity as the 6th is written in. That is, as for the up field of a screen, the scanning line spreads from a before image to the scanning line under one (the 7th scanning line).

[0081] In the polarity-reversals field of the pixel electrode in a staging area, one pixel on the 8th, the 9th, the 11th, the 12th, and the 13th scanning line is chosen at a time for the scanning line one by one, the polarity is reversed to a scan last time, and the same polarity as a scan is written in only for the pixel on the 10th scanning line which is the 3rd scanning line in the polarity-reversals field of a pixel electrode last time. And it is moving in the polarity-reversals field of the pixel electrode of the image of the 3rd frame to the field (the 8th - the 13th scanning line) of the scanning line under one from the polarity-reversals field (the 7th - the 12th scanning line) of the pixel electrode at the time of the image of the 2nd frame. In the lower field of a screen, the one scanning line is chosen at a time one by one in the 14th, 15th, and 16th order, and the same straight polarity as the time of a scan is written in last time.

[0082] Although there is a possibility that a flicker may occur on a screen, in invention of the gestalt 3 of operation since the period which a pixel polarity reverses in the polarity-reversals field of a pixel electrode becomes large compared with the gestalt 1 of operation, or 2 In invention by the gestalt of this operation, by constituting many number of the scanning lines with which a pixel polarity is reversed for every scan in the reversal field of a pixel electrode from number of the scanning lines with which a pixel polarity is reversed spacing more than a scan period (every [for example,] 2 scan periods) The mean wave period of the polarity reversals in the reversal field of a pixel electrode can be shortened compared with the case of the gestalt 3 of operation. Therefore, there is characteristic effectiveness that generating of a flicker can also be prevented, aiming at reduction of the power consumption of the actuation circuit by making a pixel reversal frequency low.

[0083] In addition, also with the gestalt of this operation, although 1 field ****** case was shown on the display screen, even if it prepares two or more polarity-reversals fields of a pixel electrode, there is same effectiveness. Moreover, although the case where the polarity of the pixel of the scanning lines other than the polarity-reversals field of a pixel electrode was straight polarity forward was explained, it is good also as a polarity in which may be negative polarity or the up field of a screen differs mutually from a lower field.

[0084] Gestalt 5. drawing 9 of operation is drawing for explaining signs that the scanning line is chosen on the screen of the liquid crystal display in the gestalt 5 of operation, and is setting to 26 several K of the scanning line which constitutes the image of one frame in order to give explanation of operation easy also in the gestalt of this operation. Drawing 10 is drawing for explaining the condition of the polarity reversals of the sequence (actuation sequence) which chooses the scanning line, and a pixel electrode in the liquid crystal display in the gestalt 5 of

operation. The scanning line which invention by the gestalt of this operation makes [scanning line] reverse mutually the polarity of the up field of a screen, and a lower field, and reverses a polarity for the pixel polarity of the scanning line in the polarity-reversals field of a pixel electrode for every scan further, The polar ratio (namely, ratio of the number of pixels of a forward electrical potential difference, and the number of pixels of a negative electrical potential difference) of the pixel which constitutes a polarity from the scanning line changed spacing more than a scan period, and is occupied in the field between an up field and a lower field It is characterized by making it correspond to the polarity of an up field and a lower field, and making it increase or decrease.

[0085] Hereafter, an example is explained using drawing 9 and drawing 10 . In the gestalt of this operation, when the polarity-reversals field of a pixel electrode is located in the pars intermedia of a screen, the polarity of the pixel of the scanning line of the upper part of a screen and a lower field is mutually made into reverse, and it is made the same last time at the time of a scan. moreover, in the polarity-reversals field of the pixel electrode in the staging area of a screen It constitutes from a pixel to which the polarity of the pixel of the scanning line is changed for every scan, and a pixel to which a polarity is changed spacing more than a scan period. Between an up field and a lower field, the polar ratio (namely, ratio of the number of pixels of a forward electrical potential difference and the number of pixels of a negative electrical potential difference) of the pixel occupied in the polarity-reversals field of a pixel electrode is made to correspond to the polarity of an up field and a lower field, and is increased or decreased. And it is characterized by moving the one scanning line at a time the polarity-reversals field of such a pixel electrode down the screen for every frame scanning.

[0086] First, as the first image (namely, image of the 1st frame in time of day t0 - time of day t1) is shown in drawing 10 (a), in the up field of the screen shown in drawing 12 , sequential selection of every one scanning line is made at the order of the 1st, 2nd, 3rd, 4th, and 5th scanning line. the pixel of the 1st - the 4th scanning line is last time the same as that of the time of a scan, for example, straight polarity writes it in -- having -- the pixel of the 5th scanning line -- the 1- the same straight polarity as the 4th is written in.

[0087] In the polarity-reversals field of a pixel polarity in the staging area of a screen The scanning line the pixel on the 6th, the 9th, the 10th, the 12th, the 13th, the 14th, the 16th, the 17th, the 20th, and the 21st scanning line One is chosen at a time one by one, the polarity of pair Perilla frutescens (L.) Britton var. crispa (Thunb.) Decne. is reversed by scan last time, and the same polarity as a scan is written in for the pixel on the 7th, the 8th, the 11th, the 15th, the 18th, and the 19th scanning line last time. Consequently, as shown in drawing 10 (a), in the polarity-reversals field of a pixel polarity in the gestalt of this operation, the scanning line whose polarity of a pixel is straight polarity turns into the 7th, 8th, 9th, 11th, 12th, 14th, 17th, and 21st scanning line, and the scanning line whose polarity of a pixel is negative polarity turns into the 6th, 10th, 13th, 15th, 16th, 18th, 19th, and 20th scanning line.

[0088] That is, the ratio of the scanning line which the pixel of straight polarity occupies is enlarged, so that it becomes a field near the up field of the screen which is straight polarity in the polarity-reversals field of the pixel electrode in the gestalt of this operation, and the ratio of the scanning line which the pixel of negative polarity occupies is enlarged, so that it becomes a field near the lower field of the screen which is negative polarity. In the lower field of a screen, in the 22nd, 23rd, 24th, 25th, and 26th order, the one scanning line is chosen at a time one by one, and makes it the polarity of an up field, and reverse, and the same negative polarity as the time of a scan is written in last time.

[0089] As the following image of the 2nd frame shows to drawing 10 (b), in the field of the screen upper part, the one scanning line is chosen at a time in the 1st, 2nd, 4th, 5th, and 6th order. the same straight polarity as the time of a scan writes in the pixel of the 1st - the 5th scanning line last time -- having -- the pixel of the 6th scanning line -- the 1- the same straight polarity as the 5th is written in. That is, as for the up field of a screen, the scanning line spreads from a before image to the scanning line under one (the 6th scanning line).

[0090] In the polarity-reversals field of a pixel polarity in the staging area of a screen The scanning line the pixel on the 7th, the 10th, the 11th, the 13th, the 14th, the 15th, the 17th, the 18th, the 21st, and the 22nd scanning line One is chosen at a time one by one, the polarity of pair Perilla frutescens (L.) Britton var. crispa (Thunb.) Decne. is reversed by scan last time, and the same polarity as the time of a scan is written in for the pixel on the 8th, the 9th, the 12th, the 16th, the 19th, and the 20th scanning line last time. Consequently, as shown in drawing 10 (b), in the polarity-reversals field of a pixel polarity in the gestalt of this operation, the scanning line whose polarity of a pixel is straight polarity turns into the 8th, 9th, 10th, 12th, 13th, 15th, 18th, and 22nd scanning line, and the scanning line whose polarity of a pixel is negative polarity turns into

the 7th, 11th, 14th, 16th, 17th, 19th, 20th, and 21st scanning line.

[0091] That is, also in the gestalt of this operation, it is moving in the polarity-reversals field of the pixel electrode of the image of the 2nd frame to the field (the 7th - the 22nd scanning line) of the scanning line under one from the polarity-reversals field (the 6th - the 21st scanning line) of the pixel electrode at the time of the image of the 1st frame. In the lower field of a screen, in the 23rd, 24th, 25th, and 26th order, the one scanning line is chosen at a time one by one, and makes it the polarity of an up field, and reverse, and the same negative polarity as the time of a scan is written in last time. Henceforth, after the polarity-reversals field of a pixel polarity moves to order toward a screen lower part and the polarity-reversals field of a pixel electrode runs against the 26th lowermost scanning line in a screen, it moves toward the lower part again from the screen upper part. At this time, the polarity of the screen upper part and the lower part is reversed. That is, the up field of a screen is reversed from straight polarity to negative polarity, and a lower field is reversed to negative polarity or ********.

[0092] Then, as shown in drawing 10 (c), as for an up field, sequential selection of every one scanning line is made at the order of the 1st, 2nd, 3rd, 4th, and 5th scanning line. the same straight polarity as the time of a scan writes in the pixel of the 1st - the 4th scanning line last time -- having -- the pixel of the 5th scanning line -- the 1- the same straight polarity as the 4th is written in. In the polarity-reversals field of the pixel electrode in a screen staging area The scanning line the pixel on the 6th, the 9th, the 10th, the 12th, the 13th, the 14th, the 16th, the 17th, the 20th, and the 21st scanning line One is chosen at a time one by one, the polarity of pair Perilla frutescens (L.) Britton var. crispa (Thunb.) Decne. changes to a scan last time, and the same polarity as a scan is written in for the pixel on the 7th, the 8th, the 11th, the 15th, the 18th, and the 19th scanning line last time.

[0093] In a lower field, in the 22nd, 23rd, 24th, 25th, and 26th order, the one scanning line is chosen at a time one by one, and makes it the polarity of an up field, and reverse, and the same negative polarity as the time of a scan is written in last time. By doing in this way, in Kamasu fields other than the polarity-reversals field of a pixel electrode, since a pixel is charged by direct current, a flicker does not occur. Moreover, in order that the polarity-reversals field of a pixel electrode may carry out sequential migration from the upper part to a lower part on a screen, the impression time amount at the time of each polarity becomes equal, and it is hard coming to carry out liquid crystal degradation.

[0094] The place of invention by the gestalt of this operation by which it is characterized most The scanning line which the polarity of the up field of a screen and a lower field is mutually made [scanning line] into reverse, and reverses a polarity for the pixel polarity of the scanning line in the polarity-reversals field of a pixel electrode for every scan further, The polar ratio (namely, ratio of the number of pixels of a forward electrical potential difference, and the number of pixels of a negative electrical potential difference) of the pixel which constitutes a polarity from the scanning line changed spacing more than a scan period, and is occupied in the field between an up field and a lower field It is in the ability to make the inclination of a brightness difference loose by making it correspond to the polarity of an up field and a lower field, and making it increase or decrease.

[0095] If this description is explained concretely, as mentioned above, for example, as shown in drawing 10 (b) In the polarity-reversals field (field of the 7th - the 22nd scanning line) of a pixel electrode, the scanning line with which straight polarity is written in a pixel It is the 8th, 9th, 10th, 12th, 13th, 15th, 18th, and 22nd scanning line, and the scanning line with which negative polarity is written in is the 7th, 11th, 14th, 16th, 17th, 19th, 20th, and 21st scanning line. Moreover, the polarity of the pixel of the 23-26th scanning lines in the lower field of a screen is negative polarity, and the polarity of the pixel of the 1-6th scanning lines in the up field of a screen is straight polarity, and it is making the rate that negative polarity occupies it to be missing from the bottom-of-screen side which is negative polarity, and increase from the screen upper part side which is straight polarity for a time in the polarity-reversals field of the pixel electrode in the gestalt of this operation, in drawing 10 (b).

[0096] In other words, the rate that straight polarity occupies from the screen upper part side which is straight polarity, applying to the bottom-of-screen side which is negative polarity is decreased for a time. Thus, with the gestalt of this operation, it is made for the inclination of the brightness difference in a screen to become loose, and is hard to recognize a brightness difference by making the polarity of the pixel electrode of the scanning line equivalent to the polarity of an up field or a lower field, and increasing or decreasing it for a time in the polarity-reversals field of a pixel electrode.

[0097]

[Effect of the Invention] While choosing a sequential-scanning line from the liquid crystal panel with which two or more scanning lines and

signal lines carried out [each-other] the crossover, and were prepared, and the pixel electrode was formed in each intersection in the shape of a matrix, and two or more scanning lines according to the liquid crystal display concerning this invention The polar signal of either straight polarity or negative polarity is given to two or more signal lines, and it has the screen actuation control section which carries out actuation control of the image displayed on the screen of a liquid crystal panel. A screen actuation control section While making into the polarity-reversals field of a pixel electrode the image field which consists of two or more continuous scanning lines and making the polarity of reverse reverse the polarity of the pixel electrode of the predetermined scanning line in the polarity-reversals field of a pixel electrode with the polarity at the time of a scan last time for every frame scanning Since it was made to move the 1 scanning line of polarity-reversals fields of a pixel electrode at a time Since it charges with polar direct current voltage with the same pixel of the scanning line in image fields other than the polarity-reversals field of a pixel electrode, a flicker of a screen by not generating but always moving the polarity-reversals field of a pixel electrode While it is lost that the same polar electrical potential difference is impressed to the pixel electrode of the one scanning line for a long time and being able to prevent liquid crystal degradation in the whole screen, the outstanding effectiveness that the brightness difference by the scanning line which performed polarity reversals is also mitigable further is done so.

[0098] Moreover, it is ****** to prevent degradation of liquid crystal further, since it is characterized by being all the scanning lines [according to the liquid crystal display concerning this invention / in / in the predetermined scanning line / the polarity-reversals field of a pixel electrode] and the polarity of a pixel electrode is reversed for every scanning line in the polarity-reversals field of a pixel electrode.

[0099] Moreover, according to the liquid crystal display concerning this invention, in the polarity-reversals field of the pixel electrode, since it is characterized by the adjoining thing for which the polarity is changed for every scanning line, prevention of the brightness unevenness in the polarity-reversals field of a pixel electrode can be aimed at further.

[0100] Moreover, since according to the liquid crystal display concerning this invention a screen actuation control section controls the polarity of the pixel electrode of the scanning line of the up field of a screen, and a lower field further to become a mutually different polarity when the polarity-reversals field of a pixel electrode is in the staging area of a screen, the positive/negative of an electrical potential difference which joins the whole pixel side of liquid crystal can be balanced, and it is effective in degradation of liquid crystal decreasing more.

[0101] Moreover, while choosing a sequential-scanning line from the liquid crystal panel with which two or more scanning lines and signal lines carried out [each-other] the crossover, and were prepared, and the pixel electrode was formed in each intersection in the shape of a matrix, and two or more scanning lines according to the liquid crystal display concerning this invention The polar signal of either straight polarity or negative polarity is given to two or more signal lines, and it has the screen actuation control section which carries out actuation control of the image displayed on the screen of a liquid crystal panel. A screen actuation control section Make into the polarity-reversals field of a pixel electrode the image field which consists of two or more continuous scanning lines, and it sets to the polarity-reversals field of a pixel electrode. While reversing the polarity of the pixel electrode of the predetermined scanning line the scan period more than a frame-scanning period and making the polarity of reverse reverse the polarity of the pixel electrode of the scanning line which remains with the polarity at the time of a scan last time for every frame scanning Since it moves the 1 scanning line of polarity-reversals fields of a pixel electrode at a time for every frame scanning By a flicker not occurring on a screen, since it charges with polar direct current voltage with the same pixel of the scanning line in image fields other than the polarity-reversals field of a pixel electrode, and always moving the polarity-reversals field of a pixel electrode Since it is lost that the same polar electrical potential difference is impressed to the pixel electrode of the one scanning line for a long time, liquid crystal degradation can be prevented in the whole screen and the frequency of the polarity reversals of the pixel electrode in the polarity-reversals field of a pixel electrode becomes low further, It is effective in the ability to reduce the power consumption of the circuit which drives a liquid crystal panel.

[0102] Moreover, since it is characterized by the predetermined scanning lines being two or more scanning lines chosen every other in the polarity-reversals field of a pixel electrode according to the liquid crystal display concerning this invention, it decreases that long duration impression of the same polar electrical potential difference is carried out to the pixel electrode of the one scanning line in ********** of a pixel electrode, and liquid crystal degradation can be

mitigated.

[0103] Moreover, generating of a flicker can also be prevented, aiming at reduction of the power consumption of the actuation circuit by making a pixel reversal frequency low in ********** of a pixel electrode, since it is characterized by the predetermined scanning line being the one scanning line of eye predetermined watch according to the liquid crystal display concerning this invention.

[0104] Moreover, while choosing a sequential-scanning line from the liquid crystal panel with which two or more scanning lines and signal lines carried out [each-other] the crossover, and were prepared, and the pixel electrode was formed in each intersection in the shape of a matrix, and two or more scanning lines according to the liquid crystal display concerning this invention The polar signal of either straight polarity or negative polarity is given to two or more signal lines, and it has the screen actuation control section which carries out actuation control of the image displayed on the screen of a liquid crystal panel. A screen actuation control section When the image field which consists of two or more continuous scanning lines is made into the polarity-reversals field of a pixel electrode and the polarity-reversals field of a pixel electrode is in the staging area of a screen, While controlling the polarity of the pixel electrode of the scanning line of the up field of a screen, and a lower field to become a mutually different polarity It constitutes from the scanning line which reverses a polarity for the polarity-reversals field of a pixel electrode for every scan, and the scanning line which reverses a polarity spacing more than a scan period. Between an up field and a lower field, make the polar ratio of the pixel occupied in the polarity-reversals field of a pixel electrode correspond to the polarity of an up field and a lower field, and it is increased or decreased. And since it moves the 1 scanning line of polarity-reversals fields of a pixel electrode at a time for every frame scanning Since it charges with polar direct current voltage with the same pixel of the scanning line in image fields other than the polarity-reversals field of a pixel electrode, a flicker of a screen by not generating but always moving the polarity-reversals field of a pixel electrode While it is lost that the same polar electrical potential difference is impressed to the pixel electrode of the one scanning line for a long time and being able to prevent liquid crystal degradation in the whole screen Furthermore, the inclination of the brightness difference of the polarity-reversals field of a pixel electrode and the other field becomes loose, and there is outstanding effectiveness of being hard coming to recognize the brightness difference in the display screen.

[0105] Moreover, according to the actuation approach of the liquid crystal display concerning this invention, the image field which consists of two or more continuous scanning lines is made into the polarity-reversals field of a pixel electrode. While making the polarity of reverse reverse the polarity of the pixel electrode of the predetermined scanning line in the polarity-reversals field of the above-mentioned pixel electrode with the polarity at the time of a scan last time for every frame scanning Since it moves the 1 scanning line of polarity-reversals fields of a pixel electrode at a time, and it charges with polar direct current voltage with the same pixel of the scanning line in image fields other than the polarity-reversals field of a pixel electrode, a flicker of a screen is not generated. While it is lost that the same polar electrical potential difference is impressed to the pixel electrode of the one scanning line by always moving the polarity-reversals field of a pixel electrode for a long time and being able to prevent liquid crystal degradation in the whole screen, the brightness difference by the scanning line which performed polarity reversals is also mitigable further.

[0106] Moreover, according to the actuation approach of the liquid crystal display concerning this invention, make into the polarity-reversals field of a pixel electrode the image field which consists of two or more continuous scanning lines, and it sets to the polarity-reversals field of a pixel electrode. While reversing the polarity of the pixel electrode of the predetermined scanning line the scan period more than a frame-scanning period and making the polarity of reverse reverse the polarity of the pixel electrode of the scanning line which remains with the polarity at the time of a scan last time for every frame scanning Since it moves the 1 scanning line of polarity-reversals fields of a pixel electrode at a time for every frame scanning By a flicker not occurring on a screen, since it charges with polar direct current voltage with the same pixel of the scanning line in image fields other than the polarity-reversals field of a pixel electrode, and always moving the polarity-reversals field of a pixel electrode Since it is lost that the same polar electrical potential difference is impressed to the pixel electrode of the one scanning line for a long time, liquid crystal degradation can be prevented in the whole screen and the frequency of the polarity reversals of the pixel electrode in the polarity-reversals field of a pixel electrode becomes low further, The power consumption of the circuit which drives a liquid crystal panel can be reduced.

[0107] Moreover, when according to the actuation approach of the liquid crystal display concerning

this invention the image field which consists of two or more continuous scanning lines is made into the polarity-reversals field of a pixel electrode and the polarity-reversals field of a pixel electrode is in the staging area of a screen, While controlling the polarity of the pixel electrode of the scanning line of the up field of a screen, and a lower field to become a mutually different polarity It constitutes from the scanning line which reverses a polarity for the polarity-reversals field of a pixel electrode for every scan, and the scanning line which reverses a polarity spacing more than a scan period. Between an up field and a lower field, make the polar ratio of the pixel occupied in the polarity-reversals field of the above-mentioned pixel electrode correspond to the polarity of an up field and a lower field, and it is increased or decreased. And since it moves the 1 scanning line of polarity-reversals fields of the above-mentioned pixel electrode at a time for every frame scanning Since it charges with polar direct current voltage with the same pixel of the scanning line in image fields other than the polarity-reversals field of a pixel electrode, a flicker of a screen by not generating but always moving the polarity-reversals field of a pixel electrode While it is lost that the same polar electrical potential difference is impressed to the pixel electrode of the one scanning line for a long time and being able to prevent liquid crystal degradation in the whole screen, the inclination of the brightness difference of the polarity-reversals field of a pixel electrode and the other field becomes loose further, and it is hard coming to recognize the brightness difference in the display screen.

[Brief Description of the Drawings]

[Drawing 1] It is the perspective view showing notionally the outline configuration of the liquid crystal display in this invention.

[Drawing 2] It is the block diagram showing the outline configuration of the liquid crystal panel in drawing 1, and an image actuation control section.

[Drawing 3] It is the representative circuit schematic having expanded and shown liquid crystal panel 2 part.

[Drawing 4] It is drawing for explaining signs that the scanning line is chosen on the screen of the liquid crystal display by the gestalten 1-4 of operation.

[Drawing 5] In the liquid crystal display by the gestalt 1 of operation, it is drawing for explaining the condition of the actuation sequence of the scanning line, and the polarity reversals of a pixel electrode.

[Drawing 6] In the liquid crystal display by the gestalt 2 of operation, it is drawing for explaining the condition of the actuation sequence of the scanning line, and the polarity reversals of a pixel electrode.

[Drawing 7] In the liquid crystal display by the gestalt 3 of operation, it is drawing for explaining the condition of the actuation sequence of the scanning line, and the polarity reversals of a pixel electrode.

[Drawing 8] In the liquid crystal display by the gestalt 4 of operation, it is drawing for explaining the condition of the actuation sequence of the scanning line, and the polarity reversals of a pixel electrode.

[Drawing 9] It is drawing for explaining signs that the scanning line is chosen on the screen of the liquid crystal display by the gestalt 5 of operation.

[Drawing 10] In the liquid crystal display by the gestalt 5 of operation, it is drawing for explaining the condition of the actuation sequence of the scanning line, and the polarity reversals of a pixel electrode.

[Drawing 11] It is drawing for explaining the actuation approach of the conventional liquid crystal display.

[Drawing 12] In the conventional liquid crystal display, it is drawing for explaining the condition of the actuation sequence of the scanning line, and the polarity reversals of a pixel electrode.

[Drawing 13] It is drawing for explaining an example of the false DC actuation method in the conventional liquid crystal display.

[Description of Notations]

1 Liquid Crystal Display 2 Liquid Crystal Panel 3 Image Actuation Control Section

4 Light Source 5 Light Source Actuator 10 Display-Control Circuit

11 Inverting Circuit 12 X-Driver 13 Shift Register

14 Sample Hold Circuit 15 Y Driver

L1-L16 Scanning line D1-D20 Signal line

20 Display Panel 21 Pixel Section 22 Switching Element

27 Counterelectrode 28 Pixel Electrode

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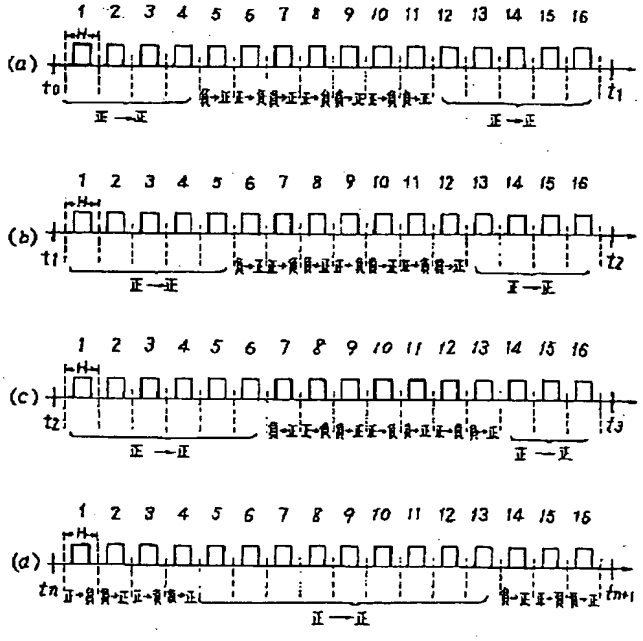
(54)【発明の名称】　液晶表示装置およびその駆動方法

(57)【要約】
【課題】　画面のちらつきおよび液晶の劣化を防止できると共に、極性反転を行った走査線による表示画面上の輝度差を軽減させることのできる液晶表示装置を提供する。
【解決手段】　液晶パネルの画面に表示される画像を駆動制御する画面駆動制御部を備え、該画面駆動制御部は、連続する複数本の走査線で構成される画像領域を画素電極の極性反転領域とし、フレーム走査毎に画素電極の極性反転領域における所定の走査線の画素電極の極性を前回走査時の極性とは逆の極性に反転させると共に、画素電極の極性反転領域を１走査線ずつ移動させる。



【特許請求の範囲】

【請求項１】　複数の走査線と信号線が互い交差して設けられ、それぞれの交点に画素電極がマトリックス状に形成された液晶パネルと、

上記複数の走査線から順次走査線を選択すると共に、上記複数の信号線に正極性あるいは負極性のいずれかの極性の信号を与え、上記液晶パネルの画面に表示される画像を駆動制御する画面駆動制御部とを備え、

上記画面駆動制御部は、連続する複数本の走査線で構成される画像領域を画素電極の極性反転領域とし、フレーム走査毎に上記画素電極の極性反転領域における所定の走査線の画素電極の極性を前回走査時の極性とは逆の極性に反転させると共に、上記画素電極の極性反転領域を１走査線ずつ移動させることを特徴とする液晶表示装置。

【請求項２】　所定の走査線は、画素電極の極性反転領域におけるすべての走査線であることを特徴とする請求項１に記載の液晶表示装置。

【請求項３】　画素電極の極性反転領域は、隣接する走査線毎にその極性を異ならせることを特徴とする請求項１に記載の液晶表示装置。

【請求項４】　画面駆動制御部は、画素電極の極性反転領域が画面の中間領域にあるとき、更に画面の上部領域と下部領域の走査線の画素電極の極性を互いに異なる極性となるように制御することを特徴とする請求項１に記載の液晶表示装置。

【請求項５】　複数の走査線と信号線が互い交差して設けられ、それぞれの交点に画素電極がマトリックス状に形成された液晶パネルと、

上記複数の走査線から順次走査線を選択すると共に、上記複数の信号線に正極性あるいは負極性のいずれかの極性の信号を与え、上記液晶パネルの画面に表示される画像を駆動制御する画面駆動制御部とを備え、

上記画面駆動制御部は、連続する複数本の走査線で構成される画像領域を画素電極の極性反転領域とし、上記画素電極の極性反転領域において、所定の走査線の画素電極の極性をフレーム走査周期以上の走査周期で反転させ、残る走査線の画素電極の極性はフレーム走査毎に前走査時の極性とは逆の極性に反転させると共に、上記画素電極の極性反転領域をフレーム走査毎に１走査線ずつ移動させることを特徴とする液晶表示装置。

【請求項６】　所定の走査線は、画素電極の極性反転領域において、１本おきに選択される複数の走査線であることを特徴とする請求項５に記載の液晶表示装置。

【請求項７】　所定の走査線は、所定番目の１本の走査線であることを特徴とする請求項５に記載の液晶表示装置。

【請求項８】　複数の走査線と信号線が互い交差して設けられ、それぞれの交点に画素電極がマトリックス状に形成された液晶パネルと、

上記複数の走査線から順次走査線を選択すると共に、上記複数の信号線に正極性あるいは負極性のいずれかの極性の信号を与え、上記液晶パネルの画面に表示される画像を駆動制御する画面駆動制御部とを備え、

上記画面駆動制御部は、連続する複数本の走査線で構成される画像領域を画素電極の極性反転領域とし、上記画素電極の極性反転領域が画面の中間領域にあるとき、画面の上部領域と下部領域の走査線の画素電極の極性を互いに異なる極性となるように制御すると共に、上記画素電極の極性反転領域を走査毎に極性を反転させる走査線と、走査周期以上の間隔で極性を反転させる走査線とで構成し、上記画素電極の極性反転領域で占める画素の極性の比率を、上記上部領域と下部領域の間で上部領域と下部領域の極性に対応させて増加ないしは減少させ、かつ、上記画素電極の極性反転領域をフレーム走査毎に１走査線ずつ移動させることを特徴とする液晶表示装置。

【請求項９】　連続する複数本の走査線で構成される画像領域を画素電極の極性反転領域とし、フレーム走査毎に上記画素電極の極性反転領域における所定の走査線の画素電極の極性を前回走査時の極性とは逆の極性に反転させると共に、上記画素電極の極性反転領域を１走査線ずつ移動させることを特徴とする液晶表示装置の駆動方法。

【請求項１０】　連続する複数本の走査線で構成される画像領域を画素電極の極性反転領域とし、上記画素電極の極性反転領域において、所定の走査線の画素電極の極性をフレーム走査周期以上の走査周期で反転させ、残る走査線の画素電極の極性はフレーム走査毎に、前回走査時の極性とは逆の極性に反転させると共に、上記画素電極の極性反転領域をフレーム走査毎に１走査線ずつ移動させることを特徴とする液晶表示装置の駆動方法。

【請求項１１】　連続する複数本の走査線で構成される画像領域を画素電極の極性反転領域とし、上記画素電極の極性反転領域が画面の中間領域にあるとき、画面の上部領域と下部領域の走査線の画素電極の極性を互いに異なる極性となるように制御すると共に、上記画素電極の極性反転領域を走査毎に極性を反転させる走査線と、走査周期以上の間隔で極性を反転させる走査線とで構成し、上記画素電極の極性反転領域で占める画素の極性の比率を、上記上部領域と下部領域の間で上部領域と下部領域の極性に対応させて増加ないしは減少させ、かつ、上記画素電極の極性反転領域をフレーム走査毎に１走査線ずつ移動させることを特徴とする液晶表示装置の駆動方法。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、アクティブマトリックス型の液晶表示パネルを用いた液晶表示装置およびその駆動方法に係わり、更に詳しくは、画素電極の極性反転を行う走査線を境にして発生する画面上の輝度差を

低減することのできる液晶表示装置およびその駆動方法に関する。

【０００２】

【従来の技術】画素ごとに、例えば、薄膜トランジスタ（以下、ＴＦＴと称す）を駆動素子として備えたアクティブマトリックス型の液晶表示素子（ＴＦＴ液晶パネル）は、隣接する画素間クロストークが無く、高コントラスト表示が得られ、透過型表示が可能であり、かつ、大型化も容易である等の利点を有しているために近年多く用いられている。図１１は従来のＴＦＴ液晶パネルの駆動方法を説明するための図である。周知のように、ＴＦＴ液晶パネルは、マトリックス状に信号線と走査線が配置されており、信号線と走査線との交点にはＴＦＴと透明な画素電極とが接続されている。そして、ＴＦＴと画素電極が設けられているアレイ基板と対向する対向基板には対向電極が設けられ、画素電極と対向電極の間には液晶が挟まれている。

【０００３】図１１には、液晶パネルの水平方向に沿って配置されている平行なｋ本の走査線（Ｌ１～ＬＫ）が示されている。図１２は、走査線の駆動順序を説明するとともに、信号線とＴＦＴとを通じて画素電極に与えられる信号の極性を説明するための図である。図１２（ａ）は、時刻t_0～t_1で形成される第１フレームの画像に対応する図であり、図１２（ｂ）は、第１フレームの次のフレームである時刻t_1～t_2で形成される第２フレームの画像に対応する図である。

【０００４】図１２（ａ）は、時刻t_0～t_1（即ち、第１フレームの画像）において、画面の上部から下部に向けて、第１～第ｋの走査線が１本ずつ順次に選択され、各走査線の選択に対応して信号線には負極性の信号が与えられ、それまで正極性であった画素電極の保持する信号は負極性の信号に順次書き換えられることを示している。尚、図において“正→負”と表示してあるのは、画素電極の極性が正極性から負極性に書き換えられることを示している。また、図において“Ｈ”と表示してあるのは、１水平走査期間を示しており、各走査線の選択の切替は１水平走査期間Ｈの周期で行われる。

【０００５】図１２（ｂ）は、時刻t_1～t_2（即ち、第２フレームの画像）において、再び画面の上部から下部に向けて第１～第ｋの走査線が一本ずつ順次選択されることを示している。このとき、信号線には正極性の信号が与えられ、応じて画素電極には正極性の信号が書き込まれ、画素電極が保持している信号は、負極性から正極性へと順次その極性が反転される。このように１フレームの画像ごとに画素電極に与える信号の極性を反転させるのは、液晶の特性劣化を防止するためである。画素電極と対向電極のあいだに挟まれた液晶は、電極間に直流電圧を印加し続けると特性が劣化する。従って、液晶に印加する信号は、適当な間隔で極性を変える必要がある。

【０００６】一般に用いられるツイステッド・ネマティック液晶を用いた液晶パネルの光学特性は電極間に加えられる電圧の絶対値に依存し、電圧の極性には依存しない。これらの液晶パネルは各画素部が保持する信号の書き換えを行う際に、図１２（ａ）および図１２（ｂ）に示すように、信号の極性も反転させる方式が採用されている。ところで、液晶表示装置に入力させる信号は、６０Ｈｚの周波数で画像データを更新される規格が普及している。この規格は、液晶表示装置よりも先行して普及したＣＲＴ（陰極線管）に準じた方式である。ＣＲＴの場合は、表示面に塗布された蛍光体に電子ビームを当てて発光させるため、輝度の減衰が早く、６０Ｈｚ程度の頻度で更新していく必要があるためである。

【０００７】液晶表示装置でも、このような６０Ｈｚの周波数で画素にデータを更新する信号を入力し、データ更新ごとに、極性を変えている。従って、極性反転の周波数は、データ更新の半分の３０Ｈｚとなる。液晶パネルにおいて、全画素位置および全階調にわたって、正極性時と負極性時の電圧の絶対値を等しく設定することは困難であり、その結果、輝度の偏差が生じる。尚、全画素位置で正極性時と負極性時の電圧の絶対値を等しく設定することが困難な理由は、画素位置によってＸドライバあるいはＹドライバから各画素までの距離が同一ではなく、そのためドライバ出力が同じであっても画素位置により画素までの配線抵抗が異なり、電圧降下量が異なるためである。また、画素位置が異なるため、遅延時間の相違により画素充電時間も異なるためである。

【０００８】また、全階調にわたって正極性時と負極性時の電圧の絶対値を等しく設定することが困難な理由は、以下のとおりである。即ち、液晶パネルの階調表示に必要な電圧は約５Ｖであり、劣化防止のためにオペアンプ等で構成した反転回路を用いて、正負方向にそれぞれ約±５Ｖの電圧を印加する。オペアンプのゲインは外付け抵抗で決まり、市販の抵抗の抵抗値のバラツキは汎用品で５～１０％、高精度品で１％程度であるため、印加される±５Ｖの電圧値にもバラツキが生じ、印加される電圧の変化率と輝度の変化率はほぼ比例すると考えられるので、全階調にわたって正極性時と負極性時の電圧の絶対値を等しく設定することができなくなる。

【０００９】ところで、人間の目にとっては１％の輝度差は容易に認識される範囲であり、市販の抵抗を使用するかぎり、全階調にわたって印加それる正負の電圧値を揃え、輝度差をなくすることは困難である。しかし、極性反転の周波数が２０～３０Ｈｚ以上となると、人間の目は輝度応答に追従できず、正極性と負極性時の平均値が輝度として視認されるため、輝度偏差によって発生するちらつきが許容範囲に入るといわれている。従って、現在の液晶表示装置は、ＣＲＴ用の信号に準じた周波数の信号を入力し、データ更新ごとにその極性を変えることで、容易にちらつきを低減できる利点がある。ところ

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で、近年、液晶表示装置は、電池駆動の携帯機器の表示装置として用いられつつある。これらの用途では、消費電力の低減の必要性が高い。液晶表示装置の場合、画素および画素を駆動する信号線の充放電の回数を減らすことで消費電力の低減が図れる。

【００１０】液晶表示装置の場合、画素が容量性の素子となるために、輝度の減衰がＣＲＴの場合と比べて遅い。従って、駆動周波数を落としても、長時間輝度を維持することが可能で、静止画においては、このような駆動方法が有効である。また、映画などは、１秒の当たりのこま送りは２４枚であり、動画再生の点からも６０Ｈｚの駆動周波数は過剰である。ただし、現在の液晶駆動方式で周波数を落とすと、データ更新に同期して液晶の極性反転周波数も遅くなり、正と負極性の輝度偏差が、ちらつきとして視認される。

【００１１】駆動周波数を落とし、ちらつきを無くすには、直流電圧を液晶に印加しつづければよいが、この場合、前述したように液晶の特性が劣化する。そこで、大半の画素は、データ更新時においても、前回と同一の電圧を印加し、一部の画素を極性反転させ、その反転周波数を液晶が劣化しない範囲まで落とせばよい。このような駆動方法にすることで、ちらつきが発生しなくなるために周波数を落とすことができ、さらに、極性反転する画素も少なくなるため充放電量も減り消費電力の低減化が可能となる。

【００１２】この問題を解決する方法として、画面領域全体のうち、一部の走査線に対応する部分の画素電極に書き込む極性のみを反転させ、それ以外の走査線に対応する部分の画素電極には前回の画像表示時における走査時と同極性の電圧を印加する擬似ＤＣ駆動方式が提案されている。（例えば、特開平１０－１３３１７６号公報参照）

図１３は、このような擬似ＤＣ駆動方式の一例を説明するための図であり、図１３（ａ）は時刻t_0～t_1における第１フレームの画像に対応する図であり、図１３（ｂ）は第１フレームの次のフレームである時刻t_1～t_2における第２フレームの画像に対応する図であり、図１３（ｃ）は時刻t_2～t_3における第３フレームの画像に対応する図であり、図１３（ｄ）は時刻t_3～t_4における第４フレームの画像に対応する図である。

【００１３】図１３（ａ）は、時刻t_0以前においては、第１～第４の走査線に対応する画素部には正極性の信号が保持されており、第５～第ｋの走査線に対応する画素部には、負極性の信号が保持されていることを示している。そして、時刻t_0～t_1において第１～第ｋの走査線が一本ずつ順次選択され、第１フレームの画像が更新される。即ち、図１３（ａ）に示すように、第１～第５の走査線に対応する画素部には正極性の信号が書き込まれ、第６～第ｋの走査線に対応する画素部には負極性の信号が書き込まれる。従って、時刻t_0～t_1においては、第５の走査線に対応する画素部が保持する信号の極性が負極性から正極性へと反転する。

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【００１４】図１３（ｂ）は、第２フレームの画像表示時において、第１～第６の走査線に対応する画素部に正極性の信号が書き込まれ、第７～第ｋの走査線に対応する画素部には負極性の信号が書き込まれることを示す。従って、時刻t_1～t_2においては、第６の走査線に対応する画素部が保持する信号の極性が負極性から正極性へと反転している。図１３（ｃ）は、第３フレームの画像表示時において、第１～第７の走査線に対応する画素部に正極性の信号が書き込まれ、第８～第ｋの走査線に対応する画素部には負極性の信号が書き込まれることを示す。従って、時刻t_2～t_3においては、第７の走査線に対応する画素部が保持する信号の極性が負極性から正極性へと反転している。

【００１５】図１３（ｄ）は、第４フレームの画像表示時において、第１～第８の走査線に対応する画素部に正極性の信号が書き込まれ、第９～第ｋの走査線に対応する画素部には負極性の信号が書き込まれることを示す。従って、時刻t_3～t_4においては、第８の走査線に対応する画素部が保持する信号の極性が負極性から正極性へと反転している。つまり、擬似ＤＣ駆動方式とは、全走査線のうちの一部の走査線に対応する画素が保持する信号の極性のみを反転させ、それ以外の走査線上の画素部には、前回走査時と同極性の信号を印加する方式である。図１３（ａ）～１６（ｄ）で示した例では、１画面（１フレームの画像）が更新されるごとに、極性を変える画素部に対応する走査線を一本ずつずらし、ｋ回の画面更新（フレーム更新）を経て、液晶パネルの全画素部が保持する信号の極性を反転させている。

【００１６】

【発明が解決しようとする課題】前述したような擬似ＤＣ駆動方法は画面のちらつきを防ぐことはできるものの、極性反転を行なった走査線を境にして画面の上下で画素電極に印加される正電圧と負電圧の間に偏差が現れ、正電圧に対応する輝度をＬｐ、負電圧に対応する輝度をＬｍとすると、輝度差は、｜Ｌｐ－Ｌｍ｜として視認されるなどの問題点があった。この発明は、画面のちらつきおよび液晶の劣化を防止できると共に、更に、極性反転を行った走査線による表示画面上の輝度差を軽減させることのできる液晶表示装置およびその駆動方法を提供することを目的とする。

【００１７】

【課題を解決するための手段】本発明に係る液晶表示装置は、複数の走査線と信号線が互い交差して設けられ、それぞれの交点に画素電極がマトリックス状に形成された液晶パネルと、複数の走査線から順次走査線を選択すると共に、複数の信号線に正極性あるいは負極性のいずれかの極性の信号を与え、液晶パネルの画面に表示される画像を駆動制御する画面駆動制御部とを備え、画面駆

動制御部は、連続する複数本の走査線で構成される画像領域を画素電極の極性反転領域とし、フレーム走査毎に画素電極の極性反転領域における所定の走査線の画素電極の極性を前回走査時の極性とは逆の極性に反転させると共に、画素電極の極性反転領域を１走査線ずつ移動させるものである。

【００１８】また、本発明に係る液晶表示装置の所定の走査線は、画素電極の極性反転領域におけるすべての走査線であることを特徴とするものである。

【００１９】また、本発明に係る液晶表示装置の画素電極の極性反転領域は、隣接する走査線毎にその極性を異ならせることを特徴とするものである。

【００２０】また、本発明に係る液晶表示装置の画面駆動制御部は、画素電極の極性反転領域が画面の中間領域にあるとき、更に画面の上部領域と下部領域の走査線の画素電極の極性を互いに異なる極性となるように制御するものである。

【００２１】また、本発明に係る液晶表示装置は、複数の走査線と信号線が互い交差して設けられ、それぞれの交点に画素電極がマトリックス状に形成された液晶パネルと、複数の走査線から順次走査線を選択すると共に、複数の信号線に正極性あるいは負極性のいずれかの極性の信号を与え、液晶パネルの画面に表示される画像を駆動制御する画面駆動制御部とを備え、画面駆動制御部は、連続する複数本の走査線で構成される画像領域を画素電極の極性反転領域とし、画素電極の極性反転領域において、所定の走査線の画素電極の極性をフレーム走査周期以上の走査周期で反転させ、残る走査線の画素電極の極性はフレーム走査毎に、前回走査時の極性とは逆の極性に反転させると共に、画素電極の極性反転領域をフレーム走査毎に１走査線ずつ移動させるものである。

【００２２】また、本発明に係る液晶表示装置の所定の走査線は、画素電極の極性反転領域において、１本おきに選択される複数の走査線であることを特徴とするものである。

【００２３】また、本発明に係る液晶表示装置の所定の走査線は、所定番目の１本の走査線であることを特徴とするものである。

【００２４】また、本発明に係る液晶表示装置は、複数の走査線と信号線が互い交差して設けられ、それぞれの交点に画素電極がマトリックス状に形成された液晶パネルと、複数の走査線から順次走査線を選択すると共に、複数の信号線に正極性あるいは負極性のいずれかの極性の信号を与え、液晶パネルの画面に表示される画像を駆動制御する画面駆動制御部とを備え、画面駆動制御部は、連続する複数本の走査線で構成される画像領域を画素電極の極性反転領域とし、画素電極の極性反転領域が画面の中間領域にあるとき、画面の上部領域と下部領域の走査線の画素電極の極性を互いに異なる極性となるように制御すると共に、画素電極の極性反転領域を走査毎

に極性を反転させる走査線と、走査周期以上の間隔で極性を反転させる走査線とで構成し、画素電極の極性反転領域で占める画素の極性の比率を、上部領域と下部領域の間で上部領域と下部領域の極性に対応させて増加ないしは減少させ、かつ、画素電極の極性反転領域をフレーム走査毎に１走査線ずつ移動させるものである。

【００２５】また、本発明に係る液晶表示装置の駆動方法は、連続する複数本の走査線で構成される画像領域を画素電極の極性反転領域とし、フレーム走査毎に上記画素電極の極性反転領域における所定の走査線の画素電極の極性を前回走査時の極性とは逆の極性に反転させると共に、画素電極の極性反転領域を１走査線ずつ移動させるものである。

【００２６】また、本発明に係る液晶表示装置の駆動方法は、連続する複数本の走査線で構成される画像領域を画素電極の極性反転領域とし、画素電極の極性反転領域において、所定の走査線の画素電極の極性をフレーム走査周期以上の走査周期で反転させ、残る走査線の画素電極の極性はフレーム走査毎に、前回走査時の極性とは逆の極性に反転させると共に、画素電極の極性反転領域をフレーム走査毎に１走査線ずつ移動させるものである。

【００２７】また、本発明に係る液晶表示装置の駆動方法は、連続する複数本の走査線で構成される画像領域を画素電極の極性反転領域とし、画素電極の極性反転領域が画面の中間領域にあるとき、画面の上部領域と下部領域の走査線の画素電極の極性を互いに異なる極性となるように制御すると共に、画素電極の極性反転領域を走査毎に極性を反転させる走査線と、走査周期以上の間隔で極性を反転させる走査線とで構成し、上記画素電極の極性反転領域で占める画素の極性の比率を、上部領域と下部領域の間で上部領域と下部領域の極性に対応させて増加ないしは減少させ、かつ、上記画素電極の極性反転領域をフレーム走査毎に１走査線ずつ移動させるものである。

【００２８】

【発明の実施の形態】以下、本発明の一実施の形態について、図面に基づいて説明する。尚、従来と同一符号のものは従来のものと同一または相当のものであることを示す。

実施の形態１．図１は、本発明の液晶表示装置の概略構成を概念的に示す斜視図である。図１において、１は液晶表示装置の全体、２は液晶パネル（例えば、ＴＦＴ液晶パネル）、３は液晶パネル２の画像を表示するための制御を行う画面駆動制御部、４は液晶パネル２の後部から液晶パネル２に対して光を照射するための光源、５は光源４を駆動するための光源駆動部である。

【００２９】液晶パネル２は、２枚のガラスなどの透明な基板からなり、それらの間に液晶が封入されている。そして、ガラス基板の一枚（アレイ基板）には、透明な画素電極と、画素電極をオンオフするためのスイッチン

グ素子（例えば、ＴＦＴ）とが形成され、他のガラス基板（対向基板）には、透明な対向電極が形成され、電極間に液晶が挟まれる。そして、各画素に対応して電圧が電極間に加えられる構成になっている。尚、対向電極はアレイ基板上において画素電極に隣接して設けても良い。

【００３０】図２は、図１における液晶パネル２および画面駆動制御部３の概略構成を示すブロック図である。図に示すように、画面駆動制御部３は、クロック信号ＣＬＯＣＫ、水平同期信号ＨＳＹＮＣおよび垂直同期信号ＶＳＹＮＣを受けて制御信号ＰＩＮＶ、Ｓ１、Ｓ２を出力する表示制御回路１０と、映像信号ＶＩＮを受け、制御信号ＰＩＮＶに従って映像信号ＶＩＮの極性を反転または正転させて信号ＶＩＮ２を出力する反転回路１１と、信号ＶＩＮ２および制御信号Ｓ１を受けるＸドライバ１２と、表示制御回路１１より制御信号Ｓ２を受けるＹドライバ１５とより構成されている。また、画像を表示するための液晶パネル２は、Ｘドライバ１２によって信号線が駆動され、Ｙドライバ１５によって走査線が駆動されることを示している。

【００３１】Ｘドライバ１２は、表示制御回路１０がクロック信号および同期信号に基づいて出力する制御信号Ｓ１を受けて順次シフトするシフトレジスタ１３と、シフトレジスタ１３の出力に基づいて、各信号線に対応する信号ＶＩＮ２を取込み、保持するサンプルホールド回路１４とを含んでいる。Ｙドライバ１５は、表示制御回路１０が水平および垂直の同期信号に基づいて出力する制御信号Ｓ２を受けて走査線を選択する。尚、図２においては、本発明の動作説明を簡単にするために、表示パネル部である液晶パネル２は走査線Ｌ１～Ｌ１６および信号線Ｄ１～Ｄ２０によって制御される１６×２０の画素部を含む構成を一例として示している。

【００３２】図３は、液晶パネル２の一部を拡大して示した等価回路図である。図３に示すように、液晶パネル２のアレイ基板上には、一方向に平行して配列される走査線Ｌ１～Ｌ３に直交して画像データに対応する信号を画素部に与える信号線Ｄ１～Ｄ３が設けられている。これらの走査線と信号線の交点には画素部２１が設けられる。各画素部２１は、画素電極２８と対向基板上に設けられる対向電極２７とを含み、画素電極２８と対向電極２７との間には液晶が挟まれておりキャパシタ２６が形成されている。

【００３３】各画素部２１は、各々の走査線との交点に対応して設けられるスイッチング素子をさらに含む。図３では、スイッチング素子としてＴＦＴ２２を含む例を示している。ＴＦＴ２２のゲート電極２５は対応する走査線に接続され、ＴＦＴ２２のドレイン電極２３は対応する信号線に接続され、ＴＦＴのソース電極２４は画素電極２２に接続される。キャパシタ２６の信号保持時間を増大させるためにキャパシタ２６と並列に保持容量（蓄積容量とも称す）が設けられる場合があるが、ここでは図示しない。

【００３４】図２および図３を参照して、本発明に係る液晶表示装置のベースとなる基本的な動作を簡単に説明する。Ｙドライバ１５によって、例えば１６本の走査線Ｌ１～Ｌ１６が順次１本ずつ選択される。走査線の選択に同期してＸドライバ１２に含まれるサンプルホールド回路１４からは、各走査線に対応する画素部に信号線Ｄ１～Ｄ２０を介して信号が送られ、走査線の終了とともにそれらの信号が各キャパシタ２６に保持される。このようにして各画素が更新され画面が更新される。尚、図１～図３を用いて説明した液晶表示装置の構成は、後に説明する実施の形態２～実施の形態５においても同様に用いられるものである。

【００３５】本実施の形態１による液晶表示装置あるいはその駆動方法では、ｋ本の走査線からなる１フレームの画像において連続する複数本（Ｍ本）の走査線で構成される画像領域を画素電極の極性反転領域とし、この画素電極の極性反転領域においては各走査線の電極極性を前回走査時および１つ前の走査線の電極極性に対して走査線毎に順次反転させると共に、その画素電極の極性反転領域を１フレーム走査毎に１走査線ずつ移動させるように液晶パネルを駆動制御することを特徴とするものである。

【００３６】本実施の形態による発明の説明を簡単にするために、１フレームの画面が１６本（即ち、Ｋ＝１６）の走査線で構成される場合について、図４および図５を用いて具体的な説明を行う。図４は、実施の形態１における液晶表示装置の画面上において、走査線が選択される様子を説明するための図であり、１フレームの画像を構成する走査線はＬ１～Ｌ１６の１６本である。尚、図４は、後述する実施の形態２～４における液晶表示装置の画面上において、走査線が選択される様子を説明するための図としても用いる。

【００３７】また、図５は、実施の形態１における液晶表示装置あるいはその駆動方法において、走査線の駆動順序と画素電極の極性反転の状態を説明するための図であり、図に付している１～１６の番号は走査線の番号である。さらに、図５は、水平走査時間単位（１Ｈ）で更新される画像信号と選択時間を時系列で示している。いま、時刻t_0～t_1の期間にある第１フレームの画像において、図４に示すように表示される画面の上部に位置する画像領域を上部領域、画面中央部に位置する画像領域を中間領域、画面の下部に位置する画像領域を下部領域とする。

【００３８】まず、図５（ａ）に示すように、最初の画像（即ち、時刻t_0～t_1の期間にある第１フレームの画像）において、画面の上部領域では、第１、第２、第３、第４、第５の走査線の順に走査線が１本ずつ順次選択される。そして、第１～第４の走査線の画素は、前回

走査時（即ち、第１フレームの１つ前のフレームの画像）と同一極性で、例えば、正極性が書き込まれ、前回走査時（即ち、１つ前のフレーム走査時）には負であった第５の走査線の画素は、第１～第４の走査線の画素と同一の正極性が書き込まれる。

【００３９】画面中央部の中間領域では、走査線が第６、第７、第８、第９、第１０、第１１の順に、順次１本ずつ選択され、走査線毎にその極性が反転される。即ち、第６の走査線の画素の極性は前回走査時の正極性から負極性へと反転し、以下、第７の走査線の画素の極性は負極性から正極性へ、第８の走査線の画素の極性は正極性から負極性へ、第９の走査線の画素の極性は負極性から正極性へ、第１０の走査線の画素の極性は正極性から負極性へ、第１１の走査線の画素の極性は負極性から正極性へと、走査線毎に前回走査時とは極性が反転し、かつ、１つ前の走査線の極性に対しても反転した極性が順次書き込まれる。即ち、第６～第１１の連続する６本の走査線で構成される領域は、第１フレームの画像においては前述の画素電極の極性反転領域に相当するものである。

【００４０】画面の下部領域では、走査線が第１２、第１３、第１４、第１５、第１６の順に、順次１本ずつ選択され、前回走査時と同一の正極性が書き込まれる。このように、時刻t_0～t_1の期間にある第１フレームの画像では、画面の上部領域にある第１～第５走査線の画素の極性は全て同一の正極性が書き込まれ、中間領域にある第６～第１１の走査線（即ち、画素電極の極性反転領域の走査線）の画素の極性は前回走査時および１つ前の走査線の画素極性とは反転した極性が書き込まれ、下部領域にある第１２～第１６走査線の画素の極性は全て上部領域の走査線と同一の正極性が書き込まれる。

【００４１】図５（ｂ）に示すように、次の画像（即ち、時刻t_1～t_2の期間にある第２フレームの画像）では、画面の上部領域では、第１、第２、第３、第４、第５、第６の順に走査線が１本ずつ選択される。第１～第５の走査線の画素は、前回走査時と同一の正極性が書き込まれ、第６の走査線の画素は第１～第５の走査線と同一の正極性が書き込まれる。つまり、第２フレームの画像の画面上部領域において、前回走査時と同一の正極性が書き込まれる領域は前画像（１つ前の第１フレームの画像）より１本下の第６の走査線まで広がる。

【００４２】画面の中間領域では、走査線が第７、第８、第９、第１０、第１１、第１２の順に、順次１本ずつ選択され、第１フレームの場合と同様に前回走査時および１つ前の走査線の画素極性とは反転した極性が書き込まれ、走査線毎に画素電極の極性が順次反転する領域（即ち、画素電極の極性反転領域）が、第６～第１１の走査線から第７～第１２の走査線へと移動する。つまり、第２フレームの画像においては、画素電極の極性反転領域は前画像（１つ前のフレーム画像）の時の画素電極の極性反転領域より走査線１本分だけ画面の下方に移動している。画面の下部領域では、走査線が第１３、第１４、第１５、第１６の順に、順次１本ずつ選択され、前回走査時と同一の正極性が書き込まれる。つまり、第２フレームの画像の画面の下部領域において前回走査時と同一の正極性が書き込まれる領域は、前画像（１つ前のフレーム画像）より走査線が１本少なくなり、狭くなっている。

【００４３】次に、図５（ｃ）に示すように、時刻t_2～t_3の期間にある第３フレームの画像の上部領域では、第１、第２、第３、第４、第５、第６、第７の順に走査線が１本ずつ選択される。第１～第６の走査線の画素は、前回走査時と同一の正極性が書き込まれ、第７の走査線の画素も第１～第６と同一の正極性が書き込まれる。つまり、第３フレームの画像の上部領域は、前画像（即ち、第２フレームの画像）より１本下の走査線（第７の走査線）まで広がる。

【００４４】中間領域では、走査線が第８、第９、第１０、第１１、第１２、第１３の順に、順次１本ずつ選択され、前回走査時および１つ前の走査線の画素極性とは反転した極性が書き込まれ、走査線毎に画素電極の極性が順次反転する領域（即ち、画素電極の極性反転領域）が移動する。つまり、第３フレームの画像の画素電極の極性反転領域は、前画像（１つ前の第２フレームの画像）の時の画素電極の極性反転領域より１本下の走査線（第８の走査線）まで移動している。画面の下部領域では、走査線が第１４、第１５、第１６の順に、順次１本ずつ選択され、前回走査時と同一の極性が書き込まれる。つまり、第３フレームの画像の下部領域は、前画像（１つ前の第２フレームの画像）より走査線が１本少なくなり、狭くなっている。

【００４５】このように、本実施の形態１による液晶表示装置あるいはその駆動方法においては、画像が１フレームつづ更新される毎に、例えば６本の走査線で構成された画素電極の極性反転領域は１走査線ずつ画面下方に移動して行き、第１６本目の走査線を越えると、図５（ｄ）に示したように画素電極の極性反転領域は画面の上部領域と下部領域に分かれて存在することになる。このようにすることで、画素電極の極性反転領域以外の画像領域における走査線の画素は同一極性の直流電圧で充電されるために、ちらつきが発生しない。また、複数の走査線で構成された画素電極の極性反転領域を常に移動させることにより、１つの走査線の画素電極に対して、正または負の同一極性の電圧が長時間印加されることがなくなるので、画面全体において液晶劣化を防ぐことができる。

【００４６】ところで、直流電圧で画素を充電する時、正電圧に対応する輝度をＬｐ、負電圧に対応する輝度をＬｍとすると、画面の上部領域と下部領域の画像面は、ＬｐないしはＬｍとなる。一般的に、人間の目の分解能

は走査線より広いため、画素電極の極性反転領域の画像面の輝度は、（Ｌｐ＋Ｌｍ）／２となる。従って、本実施の形態１による液晶表示装置においては、輝度差は、従来例の半分の｜（Ｌｐ－Ｌｍ）／２｜となる。

【００４７】即ち、本実施の形態１によれば、画面にちらつきが発生せず、全体の液晶劣化を防止できる上に、更に、極性反転を行った走査線による輝度差も軽減できるという優れた効果を奏する。なお、本実施の形態１では、画素電極極性反転領域を表示画面上に、１領域だけ設けた場合を示したが、複数設けても同様の効果がある。また、本実施の形態１では、画素電極極性反転領域以外の領域の走査線の画素電極の極性が正極性の場合を示したが、負極性としても同様の効果がある。

【００４８】実施の形態２．図６は、実施の形態２における液晶表示装置あるいはその駆動方法において、走査線を選択する順番（駆動順序）と画素電極の極性反転の状態を説明するための図である。尚、実施の形態２における液晶表示装置の画面上において、走査線が選択される様子を説明するための図としては、実施の形態１の説明で用いた図４を参照することとする。本実施の形態は、前述した実施の形態１において、更に、画素電極の極性反転領域が画面の中間領域にある時には画面の上部領域と下部領域の極性を互いに逆極性となるように液晶パネルを駆動制御することを特徴とするものであり、また、画面の上部領域と下部領域の極性を画面を所定のタイミングで反転するように液晶パネルを駆動制御することを特徴とするものである。

【００４９】以下、図４および図６に基づいて、本実施の形態による発明を説明する。図４および図６において、図に付している１～１６番号は走査線番号である。いま、時刻t_0～t_1の期間にある第１フレームの画像において、図４に示すように画面の上部に位置する画像領域を上部領域、画面中央部に位置する画像領域を中間領域、画面の下部に位置する画像領域を上部領域とする。まず、図６（ａ）に示すように、最初の画像（即ち、時刻t_0～t_1の期間にある第１フレームの画像）では、画面の上部領域は、第１、第２、第３、第４、第５の走査線の順に走査線が１本ずつ順次選択される。

【００５０】そして、第１～第４の走査線の画素は、前回走査時（即ち、第１フレームの画像の１前のフレームの画像）と同一の正極性が書き込まれ、前回走査時には負極性であった第５の走査線の画素は第１～第４の走査線と同一の正極性が書き込まれる。即ち、第１フレームの画像の第１～第５の走査線の画素はすべて同一の正極性が書き込まれる。

【００５１】画面中央部の中間領域では、走査線が第６、第７、第８、第９、第１０、第１１の順に、順次１本ずつ選択され、第６の走査線の画素電極は正極性から負極正へ、第７の走査線の画素電極は負極性から正極正へ、第８の走査線の画素電極は正極性から負極正へ、第９の走査線の画素電極は負極性から正極正へ、第１０の走査線の画素電極は正極性から負極正へ、第１１の走査線の画素電極は負極性から正極正へと、走査線毎に前回走査時とは極性が反転し、かつ、１つ前の走査線の極性に対しても反転した極性が順次書き込まれる。

【００５２】即ち、第６～第１１の連続する６本の走査線で構成される画像領域は実施の形態１で説明した画素電極の極性反転領域に相当する。画面の下部領域では、走査線が第１２、第１３、第１４、第１５、第１６の順に、順次１本ずつ選択され、上部領域の第１～第５の走査線の画素電極の極性とは逆の負極正であり、かつ、前回走査時と同一の負極性が書き込まれる。

【００５３】次に、図６（ｂ）に示すように、次の画像（即ち、時刻t_1～t_2の第２フレームの画像）では、画面の上部領域では、第１、第２、第３、第４、第５、第６の順に走査線が１本ずつ選択される。第１～第５の走査線の画素は、前回走査時と同一の正極性が書き込まれ、第６の走査線の画素は第１～第５と同一の正極性が書き込まれる。つまり、画面の上部領域は、前画像より１本下の走査線（第６の走査線）まで広がる。

【００５４】画面中央部の中間領域では、走査線が第７、第８、第９、第１０、第１１、第１２の順に、順次１本ずつ選択され、走査線毎にその極性が反転され、走査線毎に画素電極の極性が前回走査時および１つ前の走査線の極性に対して順次反転する領域（即ち、画素電極の極性反転領域）が、第６～第１１の走査線の領域より第７～第１２の走査線の領域へと移動する。つまり、本実施の形態においても第２フレームの画像の画素電極の極性反転領域は、前画像（第１フレームの画像）の時の画素電極の極性反転領域（第６～第１１の走査線）より走査線１本下の領域（第７～第１２の走査線）まで移動している。

【００５５】画面の下部領域では、走査線が第１３、第１４、第１５、第１６の順に、順次１本ずつ選択され、画面の上部領域の走査線の画素電極の極性（即ち、正極性）とは逆の極性であり、かつ、前回走査時と同一の負極性が書き込まれる。つまり、第２フレームの画像の画面の下部領域において前回走査時と同一の負極性が書き込まれる領域は、前画像（１つ前のフレーム画像）より走査線が１本少なくなり、狭くなっている。

【００５６】以後、１フレームの画像が更新される毎に画素電極の極性反転領域が１走査線ずつ画面下部方向に向かって移動し、最下部の第１６の走査線まで突き当たった後、画素電極の極性反転領域の一部は画面の上部領域に移り、更に画面上部から下部に向かって移動し、何フレームか後には図６（ｃ）に示すように、画素電極の極性反転領域は画面の中間領域へと移動してくる。この時には、画面の上部領域と下部領域の極性は反転させている。即ち、図６（ａ）あるいは図６（ｂ）の時は画面の上部領域の走査線の画素電極の極性は正極性、下部領

域の走査線の画素電極の極性は負極性であったのが、図６（ｃ）においては、上部領域では負極正に、下部領域では正極性へと極性を反転させている。

【００５７】即ち、本実施の形態では、１フレームの画像を構成する走査線の数Ｋが１６であるので、画面が１６回更新される毎に上部領域と下部領域の走査線の画素電極の極性が反転されることになる。尚、上部領域と下部領域の走査線の画素電極の極性が反転されるタイミングは、画面が１６回更新される毎ではなく、３２回、４８回等、Ｋ×ｍ（ｍは正の整数）回毎の所定のタイミングであってもよい。

【００５８】画面の上部領域と下部領域の極性を反転させた後は、図６（ｃ）に示すように、画面の上部領域では、第１、第２、第３、第４、第５の順に走査線が１本ずつ選択される。第１～第４の走査線の画素は、前回走査時と同じ負極性が書き込まれ、第５の走査線の画素は第１～第４と同一の負極性が書き込まれる。つまり、画面の上部領域は、前画像より１本下の走査線（第５の走査線）まで広がる。

【００５９】中間領域では、走査線が第６、第７、第８、第９、第１０、第１１の順に、順次１本ずつ選択され、走査線毎にその極性が反転し、画素電極の極性反転領域が移動する。下部領域は、走査線が第１２、第１３、第１４、第１５、第１６の順に、順次１本ずつ選択され、上部領域の極性と逆であり、かつ、前回走査時と同一の正極性が書き込まれる。尚、図６（ｄ）および図６（ｅ）は、画素電極極性反転領域が画面の上部領域と下部領域に分かれている場合の状態を示したものであり、図６（ｄ）は図６（ｂ）から図６（ｃ）へ移行する途中の状態を示しものである。

【００６０】以上説明したように、本実施の形態２による液晶表示装置あるいはその駆動方法では、ｋ本の走査線からなる１フレームの画像において連続する複数本（Ｍ本）の走査線で構成される画像領域を画素電極の極性反転領域とし、この画素電極の極性反転領域においては各走査線の電極極性を前回走査時および１つ前の走査線の電極極性に対して走査線毎に順次反転させると共に、その画素電極の極性反転領域を１フレーム走査毎に１走査線ずつ移動させると共に、更に、画素電極の極性反転領域が画面の中間領域にある時には画面の上部領域と下部領域の極性を互いに逆極性となるように液晶パネルを駆動することを特徴とするものである。また、更に、画面の上部領域と下部領域の極性を画面がＫ×ｍ（Ｋは画面の走査線数、ｍは正の整数）回更新される毎の所定のタイミングで反転するように液晶パネルを駆動することを特徴とするものである。

【００６１】このように、本実施の形態２による液晶表示装置あるるいはその駆動方法においては、実施の形態１の場合と同様に、画像が１フレームつづ更新される毎に、例えば６本の走査線で構成された画素電極の極性反転領域は１走査線ずつ画面下方に移動して行き、第１６本目の走査線を越えると、画素電極の極性反転領域は画面の上部領域と下部領域に分かれて存在することになる。このようにすることで、画素電極極性反転領域以外の画像領域における走査線の画素は同一極性の直流電圧で充電されるために、ちらつきが発生しない。また、複数の走査線で構成された画素電極の極性反転領域を常に移動させることにより、１つの走査線の画素電極に対して正または負の同一の極性の電圧が長時間印加されることがなくなるので、画面全体において液晶劣化を防ぐことができる。

【００６２】また、直流電圧で画素を充電する時、正電圧に対応する輝度をＬｐ、負電圧に対応する輝度をＬｍとすると、画面の上部領域と下部領域の画像面は、ＬｐないしはＬｍとなる。一般的に、人間の目の分解能は走査線より広いため、画素電極の極性反転領域の画像面の輝度は、（Ｌｐ＋Ｌｍ）／２となる。従って、実施の形態１の場合と同様に、本実施の形態においても、輝度差は、従来例の半分の｜（Ｌｐ－Ｌｍ）／２｜となり、軽減される。

【００６３】また、更に、画面の上部領域と下部領域において画素に印加される直流電圧の極性を互いに逆極性とし、かつ、所定のタイミングで交互に極性を反転させることにより、液晶の画素面全体に加わる電圧の正負のバランスが取れるので、実施の形態１の場合よりも更に液晶の劣化が少なくなるという効果がある。尚、本実施の形態でも、画素電極極性反転領域を表示画面上に１領域だけ設けた場合を示したが、複数設けても同様の効果があることは言うまでもない。

【００６４】実施の形態３．図７は、実施の形態３における液晶表示装置あるいはその駆動方法において、走査線の駆動順序と画素電極の極性反転の状態を説明するための図である。尚、実施の形態３における液晶表示装置の画面上において、走査線が選択される様子を説明するための図としては、実施の形態１の説明で用いた図４を参照することとする。本実施の形態では、実施の形態１あるいは２の画素電極の極性反転領域において、所定の走査線に対して走査周期以上の間隔（例えば、２走査周期毎）で走査線の電極極性を反転させることを特徴とするものである。

【００６５】例えば、図７に示すように、上部および下部領域の表示領域に対応する走査線の画素極性を前回走査時と同一の正極性とし、中間領域（即ち、画素電極の極性反転領域）においては１本おきに走査線の画素極性を２走査周期毎の間隔で変化させ、画素電極の極性反転領域を１フレーム走査毎に１走査線ずつ移動させる場合について説明する。まず、最初の画像（即ち、時刻t_0～t_1の期間にある第１フレームの画像）では、図７（ａ）に示すように、画面の上部領域は、第１、第２、第３、第４、第５の走査線の順に走査線が１本ずつ順次

選択される。第１～第４の走査線の画素は、前回走査時と同一で、例えば、正極性が書き込まれ、前回走査時には負極性であつた第５の走査線の画素は第１～第４と同一の正極性が書き込まれる。

【００６６】画面の中間領域にある画素電極の極性反転領域では、走査線が第６、第７、第８、第９、第１０、第１１の順に、順次１本ずつ選択されるが、図７（ａ）に示すように、第６、第８、第１０の走査線の画素電極は前回走査時と同一の極正が書き込まれ、第７、第９、第１１の走査線の画素電極は前回走査時とは逆極性の極正が書き込まれ、かつ、第６、第８、第１０の走査線の画素電極は１つ前の走査線の画素電極に対して極性が反転している。つまり、１本おきの走査線に対して２走査周期毎にその画素極性が反転されている。画面の下部領域では、走査線が第１２、第１３、第１４、第１５、第１６の順に、順次１本ずつ選択され、前回走査時と同一の正極性が書き込まれる。

【００６７】図７（ｂ）に示すように、次の画像（即ち、時刻t_1～t_2の期間にある第２フレームの画像）では、画面の上部領域では、第１、第２、第３、第４、第５、第６の順に走査線が１本ずつ選択される。第１～第５の走査線の画素は、前回走査時と同一の正極性が書き込まれ、第６の走査線の画素は第１～第５と同一の正極性が書き込まれる。つまり、画面の上部領域は、前画像より１本下の走査線（第６の走査線）まで広がる。

【００６８】画面の中間領域では、走査線が第７、第８、第９、第１０、第１１、第１２の順に、順次１本ずつ選択され、第１フレームの画像の場合と同様に、第７、第９、第１１の走査線の画素電極は前回走査時と同一の極正が書き込まれ、第８、第１０、第１２の走査線の画素電極は前回走査時とは逆極性の極正が書き込まれ、第７、第９、第１１の走査線の画素電極だけが１つ前の走査線の画素電極に対して極性が反転している。また、本実施の形態においても第２フレームの画像の画素電極の極性反転領域は、第１フレームの画像の時の画素電極の極性反転領域（第６～第１１の走査線）より１本下の走査線の領域（第７～第１２の走査線）まで移動している。

【００６９】画面の下部領域は、走査線が第１３、第１４、第１５、第１６の順に、順次１本ずつ選択され、前回走査時と同一の極性が書き込まれる。次の画像（即ち、時刻t_2～t_3の期間にある第２フレームの画像）では、図７（ｃ）に示すように、画面上部の領域では、第１、第２、第３、第４、第５、第６、第７の順に走査線が１本ずつ選択される。第１～第６の走査線の画素は、前回走査時と同一の正極性が書き込まれ、第７の走査線の画素は第１～第６と同一の正極性が書き込まれる。つまり、画面の上部領域は、走査線が前画像より１本下の走査線（第７の走査線）まで広がる。

【００７０】中間領域では、走査線が第８、第９、第１０、第１１、第１２、第１３の順に、順次１本ずつ選択され、第２フレームの画像の場合と同様に、第８、第１０、第１２の走査線の画素電極は前回走査時と同一の極正が書き込まれ、第９、第１１、第１３　の走査線の画素電極は前回走査時とは逆極性の極正が書き込まれ、第７、第９、第１３の走査線の画素電極だけが１つ前の走査線の画素電極に対して極性が反転している。

【００７１】また、第３フレームの画像の画素電極の極性反転領域は、第２フレームの画像の時の画素電極の極性反転領域（第７～第１２の走査線）より１本下の走査線の領域（第８～第１３の走査線）まで移動している。画面の下部領域では、走査線が第１４、第１５、第１６の順に、順次１本ずつ選択され、前回走査時と同一の極性が書き込まれる。

【００７２】このように、本実施の形態３による液晶表示装置においては、画像が１フレームつづ更新される毎に、例えば６本の走査線で構成され、そのうち１本おきの３本の走査線が２走査毎に極性反転され、残る３本の走査線の電極極性は１走査毎に極性反転される画素電極の極性反転領域が、１走査線ずつ画面下方に移動して行き、第１６本目の走査線を越えると、図７（ｄ）に示したように画素電極の極性反転領域は画面の上部領域と下部領域に分かれて存在することになる。

【００７３】このようにすることで、実施の形態１あるいは２の場合と同様に、画素電極の極性反転領域以外の画像領域における走査線の画素は同一極性の直流電圧で充電されるために、ちらつきが発生しない。また、複数の走査線で構成された画素電極の極性反転領域を常に移動させることにより、１つの走査線の画素電極に対して、正または負の同一極性の電圧が長時間印加されることがなくなるので、画面全体において液晶劣化を防ぐことができる。更に、画素電極の極性反転領域における画素電極の極性反転の周波数が低くなるため、実施の形態１あるいは２の場合よりも容量性負荷を有した液晶パネル２を駆動する回路（即ち、画面駆動制御部３）の消費電力を低減できるという効果がある。

【００７４】なお、本実施の形態でも、画素電極の極性反転領域を表示画面上に、１領域設けた場合を示したが、複数設けても同様の効果がある。また、画素電極の極性反転領域以外の走査線の画素の極性が正極性の場合について説明したが、負極性であってもよく、あるいは、画面の上部領域と下部領域とで互いに異なる極性としてもよい。

【００７５】実施の形態４．図８は、実施の形態４における液晶表示装置において、走査線を選択する順番（駆動順序）と画素電極の極性反転の状態を説明するための図である。尚、実施の形態３における液晶表示装置の画面上において、走査線が選択される様子を説明するための図としては、実施の形態１の説明で用いた図４を参照することとする。前述の実施の形態３における画素電極

の極性反転領域では、１本おきの走査線に対して走査周期以上の間隔（例えば、２走査周期毎）で電極極性を反転させたが、本実施の形態による発明では、画素電極の極性反転領域の所定番目の走査線のみを走査周期以上の間隔（例えば、２走査周期）で極性反転させ、残る走査線に対しては走査毎に極性反転させることにより、極性反転領域における極性反転の平均周期を実施の形態３の場合と比べて、短くしたことを特徴とするものである。

【００７６】以下、図４および図８に基づいて、本実施の形態による発明を説明する。まず、最初の画像（即ち、時刻t_0～時刻t_1における第１フレームの画像）は、図８（ａ）に示すように、画面の上部領域は、第１、第２、第３、第４、第５の走査線の順に走査線が１本ずつ順次選択される。第１～第４の走査線の画素は、前回走査時と同一で、例えば正極性が書き込まれ、第５の走査線の画素は前回走査時には負極性であったのが反転され、第１～第４の走査線と同一の正極性が書き込まれる。

【００７７】画面の中間領域にある画素電極の極性反転領域では、第６、第７、第９、第１０、第１１の走査線が順次１本ずつ選択され、各走査線の画素は前回走査時の画素極性に対しその極性が反転され、画素電極の極性反転領域の３番目の走査線である第８の走査線上の画素のみが前回走査時と同一の極性が書き込まれる。画面の下部領域では、走査線が第１２、第１３、第１４、第１５、第１６の順に、順次１本ずつ選択され、前回走査時と同一の正極性が書き込まれる。

【００７８】次の第２フレームの画像では、図８（ｂ）に示すように、画面の上部領域では、第１、第２、第３、第４、第５、第６の順に走査線が１本ずつ選択される。第１～第５の走査線の画素は、前回走査時と同一の正極性が書き込まれ、第６の走査線の画素は第１～第５と同一の正極性が書き込まれる。つまり、画面の上部領域は、走査線が前画像より１本下の走査線（第６の走査線）まで広がる。

【００７９】画面の中間領域にある画素電極の極性反転領域では、走査線が第７、第８、第１０、第１１、第１２の走査線上の画素が、順次１本ずつ選択され、前回走査時の画素極性に対しその極性が反転され、画素電極の極性反転領域における３番目の走査線である第９の走査線上の画素のみが前回走査時と同一の極性が書き込まれる。そして、本実施の形態においても第２フレームの画像の画素電極の極性反転領域は、第１フレームの画像の時の画素電極の極性反転領域（第６～第１１の走査線）より１本下の走査線の領域（第７～第１２の走査線）まで移動している。

【００８０】画面の下部領域では、走査線が第１３、第１４、第１５、第１６の順に、順次１本ずつ選択され、前回走査時と同一の正極性が書き込まれる。次の第３フレームの画像では、図８（ｃ）に示すように、画面上部の領域では、第１、第２、第４、第５、第６、第７の順に走査線が１本ずつ選択される。第１～第６の走査線の画素は、前回走査時と同一の正極性が書き込まれ、第７の走査線の画素は第１～第６と同一の正極性が書き込まれる。つまり、画面の上部領域は、走査線が前画像より１本下の走査線（第７の走査線）まで広がる。

【００８１】中間領域にある画素電極の極性反転領域では、走査線が第８、第９、第１１、第１２、第１３の走査線上の画素が、順次１本ずつ選択され、前回走査に対してその極性が反転され、画素電極の極性反転領域における３番目の走査線である第１０の走査線上の画素のみが前回走査と同一の極性が書き込まれる。そして、第３フレームの画像の画素電極の極性反転領域は、第２フレームの画像の時の画素電極の極性反転領域（第７～第１２の走査線）より１本下の走査線の領域（第８～第１３の走査線）まで移動している。画面の下部領域では、走査線が第１４、第１５、第１６の順に、順次１本ずつ選択され、前回走査時と同一の正極性が書き込まれる。

【００８２】実施の形態３の発明では、画素電極の極性反転領域において画素極性が反転する周期が実施の形態１あるいは２に比べて大きくなるため、画面上でフリッカが発生する恐れがあるが、本実施の形態による発明では、画素電極の反転領域を走査毎に画素極性が反転される走査線の数を走査周期以上（例えば、２走査周期毎）の間隔で画素極性が反転される走査線の数よりも多く構成することにより、画素電極の反転領域における極性反転の平均周期を実施の形態３の場合と比べて、短くできる。従って、画素反転周波数を低くすることによる駆動回路の消費電力の低減を図りつつ、フリッカの発生も防止できるという特有の効果がある。

【００８３】なお、本実施の形態でも、画素電極の極性反転領域を表示画面上に、１領域設けた場合を示したが、複数設けても同様の効果がある。また、画素電極の極性反転領域以外の走査線の画素の極性が正極性正の場合について説明したが、負極性であってもよく、あるいは、画面の上部領域と下部領域とで互いに異なる極性としてもよい。

【００８４】実施の形態５．図９は、実施の形態５における液晶表示装置の画面上において、走査線が選択される様子を説明するための図であり、本実施の形態においても、動作説明を容易にするために、例えば、１フレームの画像を構成する走査線の数Ｋを、２６としている。図１０は、実施の形態５における液晶表示装置において、走査線を選択する順番（駆動順序）と画素電極の極性反転の状態を説明するための図である。本実施の形態による発明は、画面の上部領域と下部領域の極性を互いに逆とし、更に、画素電極の極性反転領域における走査線の画素極性を、走査毎に極性を反転させる走査線と、極性を走査周期以上の間隔で変化させる走査線とで構成し、その領域で占める画素の極性の比率（即ち、正電圧

の画素数と負電圧の画素数の比率）を、上部領域と下部領域の間で、上部領域と下部領域の極性に対応させて増加ないしは減少させることを特徴とするものである。

【００８５】以下、図９および図１０を用いて、具体例を説明する。本実施の形態においては、画素電極の極性反転領域が画面の中間部にある場合、画面の上部および下部領域の走査線の画素の極性を互いに逆とし、かつ、前回走査時とは同一にする。また、画面の中間領域にある画素電極の極性反転領域では、走査線の画素の極性を走査毎に変化させる画素と、極性を走査周期以上の間隔で変化させる画素で構成し、画素電極の極性反転領域の中で占める画素の極性の比率（即ち、正電圧の画素数と負電圧の画素数の比率）を、上部領域と下部領域の間で、上部領域と下部領域の極性に対応させて増加ないしは減少させている。そして、このような画素電極の極性反転領域を１フレーム走査毎に走査線１本ずつ画面の下方に移動させることを特徴とするものである。

【００８６】まず、最初の画像（即ち、時刻t_0～時刻t_1における第１フレームの画像）は、図１０（ａ）に示すように、図１２に示した画面の上部領域では、第１、第２、第３、第４、第５の走査線の順に走査線が１本ずつ順次選択される。第１～第４の走査線の画素は、前回走査時と同一で、例えば正極性が書き込まれ、第５の走査線の画素は第１～第４と同一の正極性が書き込まれる。

【００８７】画面の中間領域にある画素極性の極性反転領域では、走査線が第６、第９、第１０、第１２、第１３、第１４、第１６、第１７、第２０、第２１の走査線上の画素が、順次１本ずつ選択され、前回走査に対しその極性が反転され、第７、第８、第１１、第１５、第１８、第１９の走査線上の画素が前回走査と同一の極性が書き込まれる。その結果、図１０（ａ）に示すように本実施の形態における画素極性の極性反転領域では、画素の極性が正極性である走査線は、第７、第８、第９、第１１、第１２、第１４、第１７、第２１の走査線となり、画素の極性が負極性である走査線は、第６、第１０、第１３、第１５、第１６、第１８、第１９、第２０の走査線となる。

【００８８】即ち、本実施の形態における画素電極の極性反転領域の中では、正極性である画面の上部領域に近い領域になるほど正極性の画素が占める走査線の比率を大きくし、負極性である画面の下部領域に近い領域になるほど負極性の画素が占める走査線の比率を大きくしている。画面の下部領域では、走査線が第２２、第２３、第２４、第２５、第２６の順に、順次１本ずつ選択され、上部領域の極性と逆にし、かつ、前回走査時と同一の負極性が書き込まれる。

【００８９】次の第２フレームの画像では、図１０（ｂ）に示すように、画面上部の領域では、第１、第２、第４、第５、第６の順に走査線が１本ずつ選択される。第１～第５の走査線の画素は、前回走査時と同一の正極性が書き込まれ、第６の走査線の画素は第１～第５と同一の正極性が書き込まれる。つまり、画面の上部領域は、走査線が前画像より１本下の走査線（第６の走査線）まで広がる。

【００９０】画面の中間領域にある画素極性の極性反転領域では、走査線が第７、第１０、第１１、第１３、第１４、第１５、第１７、第１８、第２１、第２２の走査線上の画素が、順次１本ずつ選択され、前回走査に対しその極性が反転され、第８、第９、第１２、第１６、第１９、第２０の走査線上の画素が前回走査時と同一の極性が書き込まれる。その結果、図１０（ｂ）に示すように本実施の形態における画素極性の極性反転領域では、画素の極性が正極性である走査線は、第８、第９、第１０、第１２、第１３、第１５、第１８、第２２の走査線となり、画素の極性が負極性である走査線は、第７、第１１、第１４、第１６、第１７、第１９、第２０、第２１の走査線となる。

【００９１】つまり、本実施の形態においても第２フレームの画像の画素電極の極性反転領域は、第１フレームの画像の時の画素電極の極性反転領域（第６～第２１の走査線）より１本下の走査線の領域（第７～第２２の走査線）まで移動している。画面の下部領域では、走査線が第２３、第２４、第２５、第２６の順に、順次１本ずつ選択され、上部領域の極性と逆にし、前回走査時と同一の負極性が書き込まれる。以後、順に画素極性の極性反転領域が画面下方に向かって移動し、画素電極の極性反転領域が画面最下部の第２６の走査線に突き当たった後、再び、画面上部から下部に向かって移動する。このとき、画面上部と下部の極性を反転させる。即ち、画面の上部領域は正極性から負極性へ、下部領域は負極性かせ正極性へ反転させる。

【００９２】その後、図１０（ｃ）に示すように、上部領域は、第１、第２、第３、第４、第５の走査線の順に走査線が１本ずつ順次選択される。第１～第４の走査線の画素は、前回走査時と同一の正極性が書き込まれ、第５の走査線の画素は第１～第４と同一の正極性が書き込まれる。画面中間領域にある画素電極の極性反転領域では、走査線が第６、第９、第１０、第１２、第１３、第１４、第１６、第１７、第２０、第２１の走査線上の画素が、順次１本ずつ選択され、前回走査に対しその極性が変わり、第７、第８、第１１、第１５、第１８、第１９の走査線上の画素が前回走査と同一の極性が書き込まれる。

【００９３】下部領域では、走査線が第２２、第２３、第２４、第２５、第２６の順に、順次１本ずつ選択され、上部領域の極性と逆にし、かつ、前回走査時と同一の負極性が書き込まれる。このようにすることで、画素電極の極性反転領域以外の加増領域では、直流で画素が充電されるために、ちらつきが発生しない。また、画素

電極の極性反転領域が画面上で上方から下方へ順次移動するために、各極性時の印加時間が等しくなり、液晶劣化がし難くなる。

【００９４】本実施の形態による発明の最も特徴とするところは、画面の上部領域と下部領域の極性を互いに逆とし、更に、画素電極の極性反転領域における走査線の画素極性を、走査毎に極性を反転させる走査線と、極性を走査周期以上の間隔で変化させる走査線とで構成し、その領域で占める画素の極性の比率（即ち、正電圧の画素数と負電圧の画素数の比率）を、上部領域と下部領域の間で、上部領域と下部領域の極性に対応させて増加ないしは減少させることにより、輝度差の傾きを緩くできることにある。

【００９５】この特徴を具体的に説明すれば、前述したように、例えば、図１０（ｂ）に示したように、画素電極の極性反転領域（第７～第２２の走査線の領域）において、画素に正極性が書き込まれる走査線は、第８、第９、第１０、第１２、第１３、第１５、第１８、第２２の走査線であり、負極性が書き込まれる走査線は、第７、第１１、第１４、第１６、第１７、第１９、第２０、第２１の走査線である。また、図１０（ｂ）では、画面の上部領域にある第１～６の走査線の画素の極性は正極性であり、画面の下部領域にある第２３～２６の走査線の画素の極性は負極性であり、本実施の形態における画素電極の極性反転領域では、正極性である画面上部側より負極性である画面下部側にかけて、負極性の占める割合を暫時増加させている。

【００９６】言い換えれば、正極性である画面上部側より負極性である画面下部側にかけて正極性の占める割合を暫時減少させている。このように、本実施の形態では、画素電極の極性反転領域で走査線の画素電極の極性を上部領域あるいは下部領域の極性に対応させて、暫時増加ないしは減少させることにより、画面上での輝度差の傾きが緩くなるようにし、輝度差を認識し難いようにしている。

【００９７】

【発明の効果】本発明に係る液晶表示装置によれば、複数の走査線と信号線が互い交差して設けられ、それぞれの交点に画素電極がマトリックス状に形成された液晶パネルと、複数の走査線から順次走査線を選択すると共に、複数の信号線に正極性あるいは負極性のいずれかの極性の信号を与え、液晶パネルの画面に表示される画像を駆動制御する画面駆動制御部とを備え、画面駆動制御部は、連続する複数本の走査線で構成される画像領域を画素電極の極性反転領域とし、フレーム走査毎に画素電極の極性反転領域における所定の走査線の画素電極の極性を前回走査時の極性とは逆の極性に反転させると共に、画素電極の極性反転領域を１走査線ずつ移動させるようにしたので、画素電極の極性反転領域以外の画像領域における走査線の画素は同一極性の直流電圧で充電されるために画面のちらつきは発生せず、画素電極の極性反転領域を常に移動させることにより、１つの走査線の画素電極に対して同一極性の電圧が長時間印加されることがなくなり、画面全体において液晶劣化を防ぐことができると共に、更に、極性反転を行った走査線による輝度差も軽減できるという優れた効果を奏する。

【００９８】また、本発明に係る液晶表示装置によれば、所定の走査線は画素電極の極性反転領域におけるすべての走査線であることを特徴とするので、画素電極の極性反転領域では走査線毎に画素電極の極性が反転されるので、液晶の劣化を更に防止することができる。

【００９９】また、本発明に係る液晶表示装置によれば、その画素電極の極性反転領域では、隣接する走査線毎にその極性を異ならせることを特徴とするので、更に画素電極の極性反転領域における輝度むらの防止を図ることができる。

【０１００】また、本発明に係る液晶表示装置によれば、画面駆動制御部は画素電極の極性反転領域が画面の中間領域にあるとき、更に、画面の上部領域と下部領域の走査線の画素電極の極性を互いに異なる極性となるように制御するので、液晶の画素面全体に加わる電圧の正負のバランスが取れ、液晶の劣化がより少なくなるという効果がある。

【０１０１】また、本発明に係る液晶表示装置によれば、複数の走査線と信号線が互い交差して設けられ、それぞれの交点に画素電極がマトリックス状に形成された液晶パネルと、複数の走査線から順次走査線を選択すると共に、複数の信号線に正極性あるいは負極性のいずれかの極性の信号を与え、液晶パネルの画面に表示される画像を駆動制御する画面駆動制御部とを備え、画面駆動制御部は、連続する複数本の走査線で構成される画像領域を画素電極の極性反転領域とし、画素電極の極性反転領域において、所定の走査線の画素電極の極性をフレーム走査周期以上の走査周期で反転させ、残る走査線の画素電極の極性はフレーム走査毎に前回走査時の極性とは逆の極性に反転させると共に、画素電極の極性反転領域をフレーム走査毎に１走査線ずつ移動させるので、画素電極の極性反転領域以外の画像領域における走査線の画素は同一極性の直流電圧で充電されるために画面にちらつきが発生せず、また、画素電極の極性反転領域を常に移動させることにより、１つの走査線の画素電極に対して同一極性の電圧が長時間印加されることがなくなり、画面全体において液晶劣化を防ぐことができ、更に、画素電極の極性反転領域における画素電極の極性反転の周波数が低くなるため、液晶パネルを駆動する回路の消費電力を低減できるという効果がある。

【０１０２】また、本発明に係る液晶表示装置によれば、所定の走査線は画素電極の極性反転領域において、１本おきに選択される複数の走査線であることを特徴とするので、画素電極の極性反転領において１つの走査線

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の画素電極に対して同一極性の電圧が長時間印加されることが少なくなり、液晶劣化を軽減できる。

【０１０３】また、本発明に係る液晶表示装置によれば、所定の走査線は所定番目の１本の走査線であることを特徴とするので、画素電極の極性反転領において画素反転周波数を低くすることによる駆動回路の消費電力の低減を図りつつ、フリッカの発生も防止できる。

【０１０４】また、本発明に係る液晶表示装置によれば、複数の走査線と信号線が互い交差して設けられ、それぞれの交点に画素電極がマトリックス状に形成された液晶パネルと、複数の走査線から順次走査線を選択すると共に、複数の信号線に正極性あるいは負極性のいずれかの極性の信号を与え、液晶パネルの画面に表示される画像を駆動制御する画面駆動制御部とを備え、画面駆動制御部は、連続する複数本の走査線で構成される画像領域を画素電極の極性反転領域とし、画素電極の極性反転領域が画面の中間領域にあるとき、画面の上部領域と下部領域の走査線の画素電極の極性を互いに異なる極性となるように制御すると共に、画素電極の極性反転領域を走査毎に極性を反転させる走査線と、走査周期以上の間隔で極性を反転させる走査線とで構成し、画素電極の極性反転領域で占める画素の極性の比率を、上部領域と下部領域の間で上部領域と下部領域の極性に対応させて増加ないしは減少させ、かつ、画素電極の極性反転領域をフレーム走査毎に１走査線ずつ移動させるので、画素電極の極性反転領域以外の画像領域における走査線の画素は同一極性の直流電圧で充電されるために画面のちらつきは発生せず、画素電極の極性反転領域を常に移動させることにより、１つの走査線の画素電極に対して同一極性の電圧が長時間印加されることがなくなり、画面全体において液晶劣化を防ぐことができると共に、更に、画素電極の極性反転領域とそれ以外の領域との輝度差の傾きが緩くなり、表示画面上での輝度差が認識し難くなるという優れた効果がある。

【０１０５】また、本発明に係る液晶表示装置の駆動方法によれば、連続する複数本の走査線で構成される画像領域を画素電極の極性反転領域とし、フレーム走査毎に上記画素電極の極性反転領域における所定の走査線の画素電極の極性を前回走査時の極性とは逆の極性に反転させると共に、画素電極の極性反転領域を１走査線ずつ移動させるので、画素電極の極性反転領域以外の画像領域における走査線の画素は同一極性の直流電圧で充電されるために画面のちらつきは発生せず、画素電極の極性反転領域を常に移動させることにより、１つの走査線の画素電極に対して同一極性の電圧が長時間印加されることがなくなり、画面全体において液晶劣化を防ぐことができると共に、更に、極性反転を行った走査線による輝度差も軽減できる。

【０１０６】また、本発明に係る液晶表示装置の駆動方法によれば、連続する複数本の走査線で構成される画像

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領域を画素電極の極性反転領域とし、画素電極の極性反転領域において、所定の走査線の画素電極の極性をフレーム走査周期以上の走査周期で反転させ、残る走査線の画素電極の極性はフレーム走査毎に、前回走査時の極性とは逆の極性に反転させると共に、画素電極の極性反転領域をフレーム走査毎に１走査線ずつ移動させるので、画素電極の極性反転領域以外の画像領域における走査線の画素は同一極性の直流電圧で充電されるために画面にちらつきが発生せず、また、画素電極の極性反転領域を常に移動させることにより、１つの走査線の画素電極に対して同一極性の電圧が長時間印加されることがなくなり、画面全体において液晶劣化を防ぐことができ、更に、画素電極の極性反転領域における画素電極の極性反転の周波数が低くなるため、液晶パネルを駆動する回路の消費電力を低減できる。

【０１０７】また、本発明に係る液晶表示装置の駆動方法によれば、連続する複数本の走査線で構成される画像領域を画素電極の極性反転領域とし、画素電極の極性反転領域が画面の中間領域にあるとき、画面の上部領域と下部領域の走査線の画素電極の極性を互いに異なる極性となるように制御すると共に、画素電極の極性反転領域を走査毎に極性を反転させる走査線と、走査周期以上の間隔で極性を反転させる走査線とで構成し、上記画素電極の極性反転領域で占める画素の極性の比率を、上部領域と下部領域の間で上部領域と下部領域の極性に対応させて増加ないしは減少させ、かつ、上記画素電極の極性反転領域をフレーム走査毎に１走査線ずつ移動させるので、画素電極の極性反転領域以外の画像領域における走査線の画素は同一極性の直流電圧で充電されるために画面のちらつきは発生せず、画素電極の極性反転領域を常に移動させることにより、１つの走査線の画素電極に対して同一極性の電圧が長時間印加されることがなくなり、画面全体において液晶劣化を防ぐことができると共に、更に、画素電極の極性反転領域とそれ以外の領域との輝度差の傾きが緩くなり、表示画面上での輝度差が認識し難くなる。

【図面の簡単な説明】

【図１】　本発明における液晶表示装置の概略構成を概念的に示す斜視図である。

【図２】　図１における液晶パネルおよび画像駆動制御部の概略構成を示すブロック図である。

【図３】　液晶パネル２一部を拡大して示した等価回路図である。

【図４】　実施の形態１～４による液晶表示装置の画面上において、走査線が選択される様子を説明するための図である。

【図５】　実施の形態１による液晶表示装置において、走査線の駆動順序と画素電極の極性反転の状態を説明するための図である。

【図６】　実施の形態２による液晶表示装置において、

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走査線の駆動順序と画素電極の極性反転の状態を説明するための図である。

【図７】　実施の形態３による液晶表示装置において、走査線の駆動順序と画素電極の極性反転の状態を説明するための図である。

【図８】　実施の形態４による液晶表示装置において、走査線の駆動順序と画素電極の極性反転の状態を説明するための図である。

【図９】　実施の形態５による液晶表示装置の画面上において、走査線が選択される様子を説明するための図である。

【図１０】　実施の形態５による液晶表示装置において、走査線の駆動順序と画素電極の極性反転の状態を説明するための図である。

【図１１】　従来の液晶表示装置の駆動方法を説明するための図である。

【図１２】　従来の液晶表示装置において、走査線の駆動順序と画素電極の極性反転の状態を説明するための図

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である。

【図１３】　従来の液晶表示装置における擬似ＤＣ駆動方式の一例を説明するための図である。

【符号の説明】

１　液晶表示装置　　２　液晶パネル　　３　画像駆動制御部

４　光源　　５　光源駆動部　　１０　表示制御回路

１１　反転回路　　１２　Ｘドライバ　　１３　シフトレジスタ

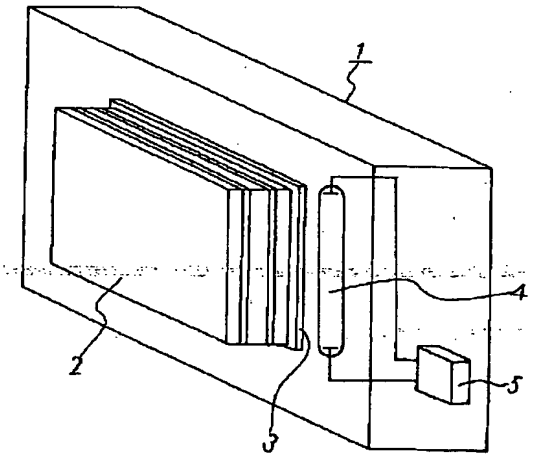
１４　サンプルホールド回路　　１５　Ｙドライバ

Ｌ１～Ｌ１６　走査線　　Ｄ１～Ｄ２０　信号線

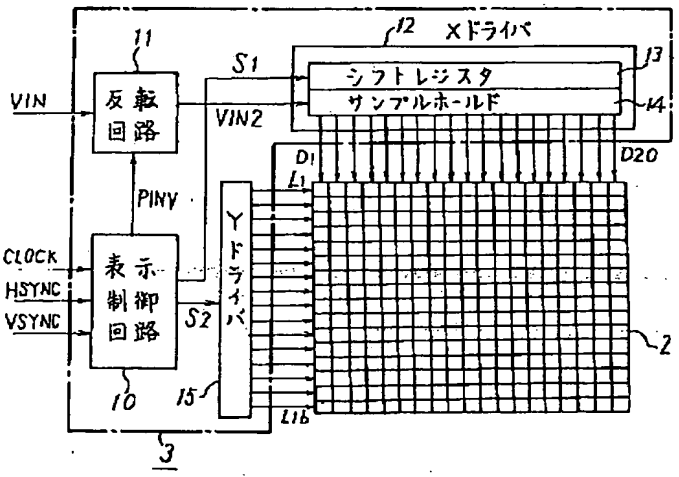
２０　表示パネル　　２１　画素部　　２２　スイッチング素子

２７　対向電極　　２８　画素電極

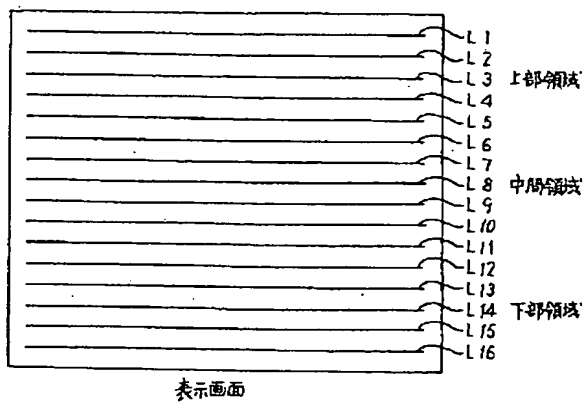
【図１】



【図２】



【図４】



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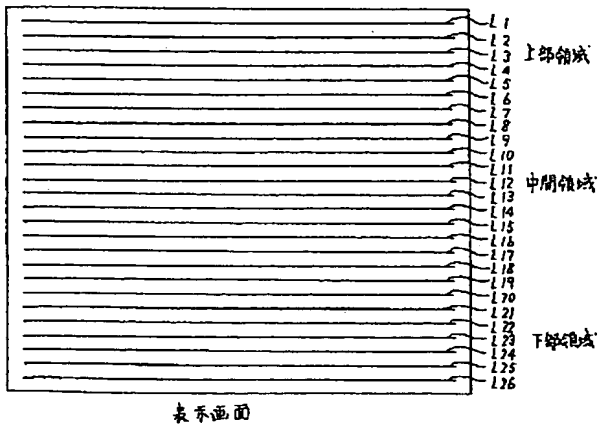

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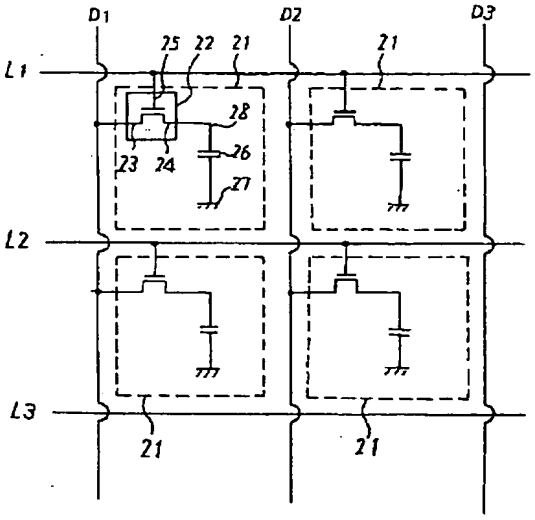

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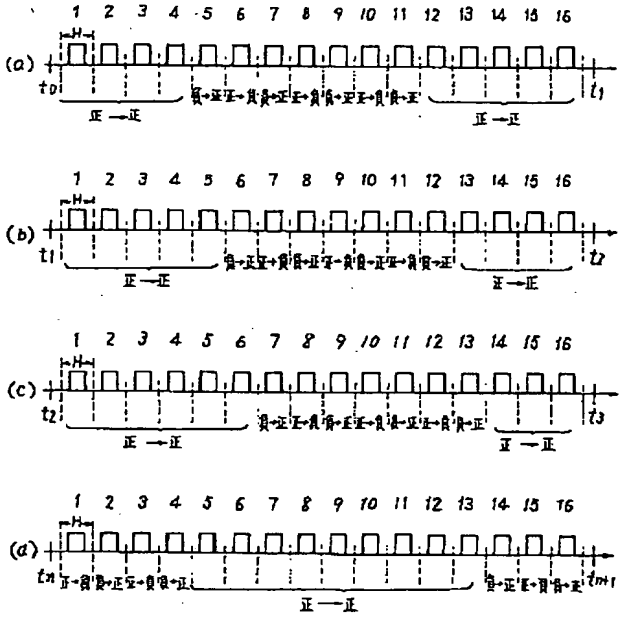

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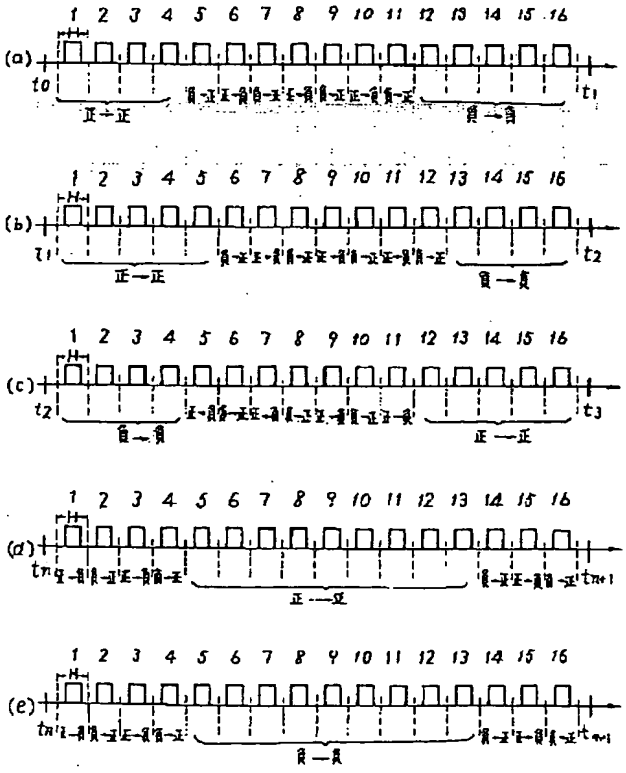

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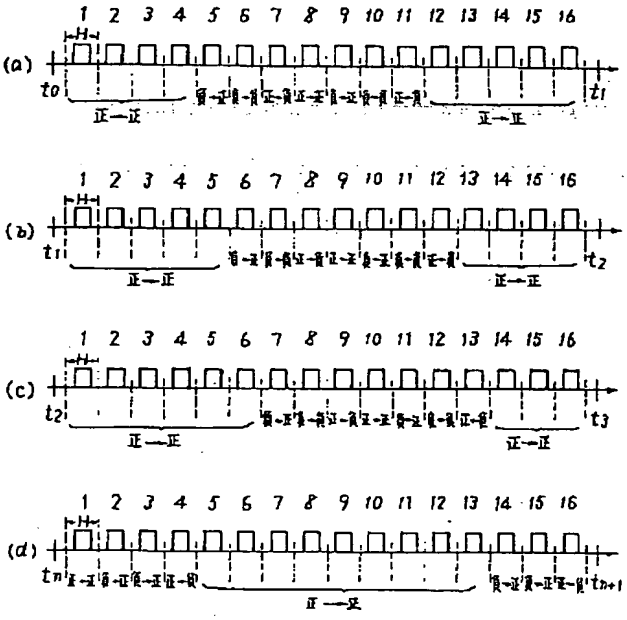

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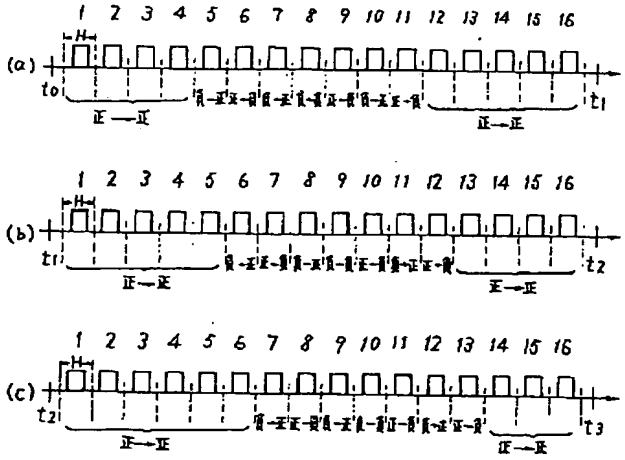

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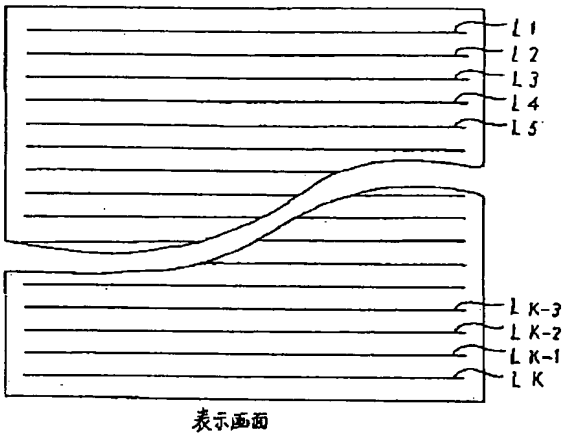

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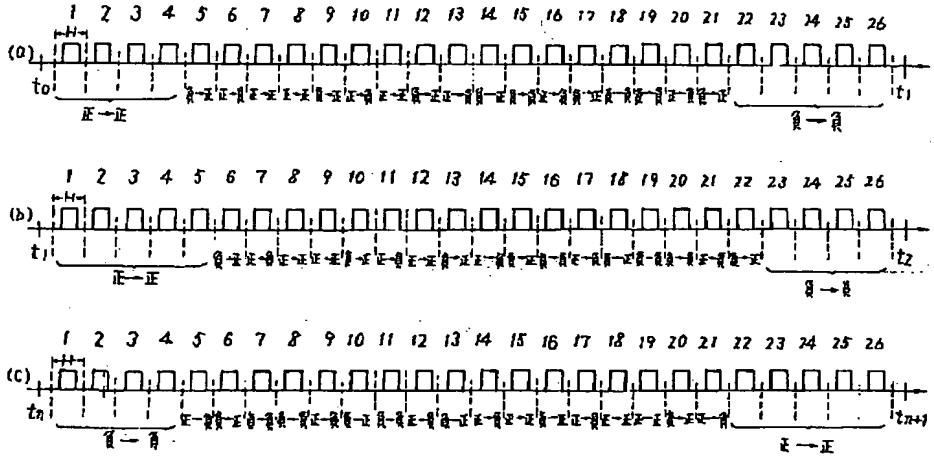

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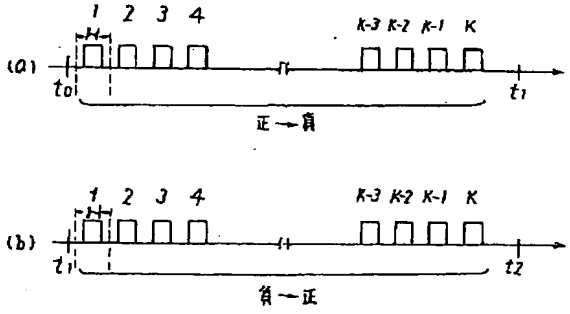
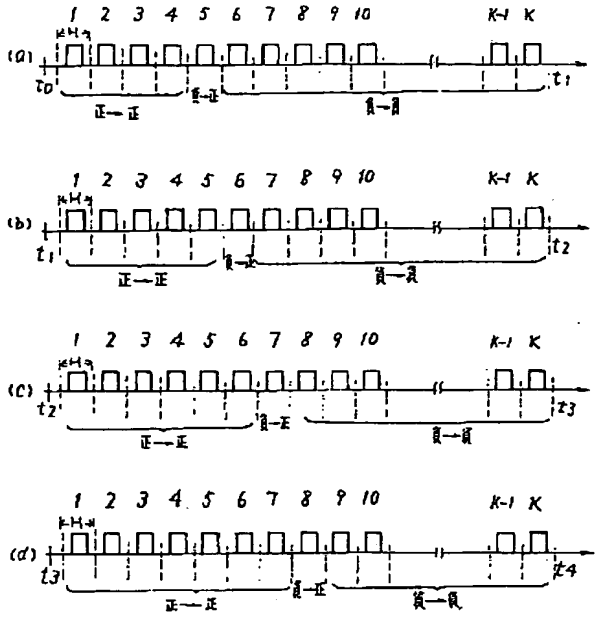


【図１３】



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